EPA/ROD/R03-02/060
2002

EPA Superfund
Record of Decision:

VIENNA TETRACHLOROETHENE
EPA ID: WVD988798401
OU 01
VIENNA, WV
09/27/2002

Record of Decision

Vienna PCE Superfund Site
Vienna, West Virginia

I. THE DECLARATION

A. Site Name and Location

Vienna PCE Superfund Site
Vienna, West Virginia
CERCLIS Identification No. WVD988798401

The Site consists of areas impacted by two separate and distinct sources of tetrachloroethene ("PCE"). The sources are Vienna Cleaners and Busy Bee Cleaners (Figure 1). Vienna Cleaners is located at the intersection of 30th Street and 5th Avenue about three blocks from City Hall, in the City of Vienna, West Virginia. The surrounding area consists of single family dwellings and private businesses. Busy Bee Cleaners is situated in a similar setting, located at the intersection of 27th Street and Grand Central Avenue.

B. Statement of Basis and Purpose

This Decision Document presents the selected remedial action for soils and groundwater for the Vienna PCE Superfund Site. This Record of Decision ("ROD") has been developed in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA") of 1980, 42 U.S.C. §§ 9601-9675, as amended by the Superfund Amendments and Re authorization Act of 1986 ("SARA"), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"), 40 C.F.R. Part 300. This decision is based on the Administrative Record for the Site

The remedy for the Site was selected by the U.S. Environmental Protection Agency. The State of West Virginia concurs with the selected remedy. (See attached letter dated September 24, 2002)

C. Assessment of Site

The response action selected in this Record of Decision ("ROD") is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Such a release or threat of release may present an imminent and substantial endangerment to public health, welfare, or the environment.

D. Description of Selected Remedy

This ROD sets forth the selected remedy for the Site, which includes groundwater and soil. This action will be the final action for this Site. The selected remedy for the Site is divided into three (3) components: Groundwater, Soils and Institutional Controls.

<u>Groundwater</u>

The selected remedy for the groundwater is an In Situ Air Sparging with Soil Vapor Extraction system which will reduce the concentrations of contaminants of concerns to risk based drinking water levels.

<u>Soils</u>

The selected remedy for soils is the reduction of PCE concentrations in the soil in the vicinity of the Vienna Cleaners property to the point where these soils no longer contribute contamination to the groundwater at levels above the Maximum Contaminant Level ("MCL") of 5 parts per billion ("ppb"). This will be accomplished through an ongoing ERA Removal Action, utilizing the Unterdruck Verdamfer Brunner ("UVB") system.

Institutional Controls

To ensure that there is no human consumption or adverse exposure to groundwater prior to the successful completion of the soils and groundwater components of this remedial action, institutional controls will be implemented to ensure that no one uses the groundwater for potable or hygienic uses such as drinking, bathing, or cooking at the Site until clean-up levels are achieved

The institutional controls will be achieved through zoning restrictions, county ordinances or local ordinances, prohibiting the placement of wells which would provide water for such uses in the vicinity of the Site.

E. Statutory Determinations

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost effective, and utilizes permanent solutions to the maximum extent practicable.

This remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment).

Because this remedy will not result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, but it will take more than five years to attain remedial action objectives and cleanup levels, a policy review will be conducted within five years of construction completion for the Site to ensure that the remedy is, or will be, protective of human health and the environment.

F. Data Certification Checklist

The following information is included in the Decision Summary section of this Record of Decision. Additional information can be found in the Administrative Record file for this Site.

- Chemicals of concern and their respective concentrations;
- Baseline risk represented by the chemicals of concern;
- Cleanup levels established for chemicals of concern and the basis of the levels;
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of ground water used in the baseline risk assessment and ROD;
- Potential land and ground water use that will be available at the Site as a result of the selected remedy;
- Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected;
- Key factor(s) that led to selecting the remedy.

G. Authorizing Signature

9/27/02

Abraham Ferdas, Director
Hazardous Site Clean-up Division
Region III

Date

II. THE DECISION SUMMARY

A. Site Name, Location and Description

The Vienna PCE Superfund Site (CERCLIS Identification No. WVD988798401) is located in Wood County, West Virginia. The Vienna PCE Site consists of two historical contamination source areas associated with dry cleaning operations and the resulting groundwater plume. The city of Parkersburg, the County seat, is immediately south of Vienna. Vienna, a residential, industrial and commercial community is approximately three square miles in area, and has a population of about 11,000 people. The city is located on the eastern bank of the Ohio River, which flows southward in the vicinity of the Site. The geographic coordinates are 81'32'30" north latitude and 39'17'30" west longitude. EPA is the lead agency and the West Virginia Department of Environmental Protection ("WVDEP") is the support agency for the Site.

Between 1998 and 2002, EPA has identified and investigated several Potentially Responsible Parties ("PRPs"). To date, none of the PRPs have sufficient resources to perform, pay for and implement the remedy. As such, cleanup monies are anticipated to come from the Superfund trust fund.

B. Site History and Enforcement Activities

PCE, a dry cleaning solvent, was first detected in Vienna's municipal drinking water wells in 1992. The facilities mentioned above have been identified as the probable sources of the groundwater contamination. PCE has been detected at highly elevated levels in surface and subsurface soils at Vienna Cleaners, in groundwater beneath the facility, and in city sewers in the immediate vicinity of the Site. Lower concentrations of PCE were detected in the groundwater in the vicinity of the Busy Bee Cleaners.

Vienna Cleaners is an active dry cleaning facility that has been in business since the late 1940's. In 1992 during a State of West Virginia inspection, the Vienna Cleaners property owner stated that past practices included pouring waste PCE directly onto the ground behind the facility. Spillage of PCE during filling of outdoor, aboveground storage tanks has also been reported. The quantity of PCE disposed of at Vienna Cleaners is unknown. A 1992 WVDEP Compliance Evaluation Inspection Report classified Vienna Cleaners as a small quantity generator under the Resource Conservation and Recovery Act ("RCRA"), producing 121 kilograms of PCE wastes each month. Busy Bee Cleaners has been in operation since the 1960's. The circumstances resulting in the release of PCE from the Busy Bee Cleaners are unknown at this time.

Due to the PCE contamination, 4 of Vienna's 12 municipal wells were shut down in 1992 (Figure 2). EPA subsequently spent emergency funds to construct two new wells (PW-V13 and PW-V14 on Figure 2). The Site was added to the CERCLA National Priorities List on October 22,1999.

In May of 2000 EPA issued General Notice/Waiver of Special Notice letters to 5 potentially responsible parties ("PRPs"). It was determined at that time that the PRPs had limited financial resources or ability to pay for the planned Remedial Investigation and Feasibility Study ("RI/FS").

A subsequent Removal Action called for the installation of the Unterdruck Verdamfer Brunner ("UVB") system at the Vienna Cleaners property. This system has been operational since March 21,2001.

C. Community Participation

The RI/FS Report, the Proposed Plan, and other relevant documents for the Vienna PCE Site, were made available to the public in July 2002. They can be found in the Administrative Record file and the information repository at the Vienna Public Library. The

Administrative Record may also be viewed electronically by accessing www.epa.gov/arweb and selecting the Vienna PCE Site. The notice of availability of these documents was published in the Parkersburg Sentinel on July 15, 2002. A public comment period was held from July 15 to August 13, 2002. In addition, a public meeting was held on July 24, 2002 to present the Proposed Plan to a broader community audience than those that had already been involved at the Site. At this meeting, representatives from EPA, the West Virginia Department of Environmental Protection and the Agency for Toxic Substances and Disease Registry answered questions about issues at the Site and the remedial alternatives. EPA also used this meeting to solicit a wider cross section of community input on the preferred remedy. EPA's responses to the comments received during this period are included in the Responsiveness Summary which is part of this Record of Decision.

D. Scope and Role of Operable Unit or Response Action

This action will be the final action for the Site. A Removal Action began in 1999 which is effectively treating the historical source area in the vicinity of Vienna Cleaners. This Removal Action consists of an Unterdruck Verdamfer Brunner ("UVB") system to remove contaminant vapors from soils in the area of Vienna Cleaners. A UVB system is a type of Soil Vapor Extraction well that operates below the soil and is completely self contained. The system and the external components it needs to operate, are located in a small building adjacent to Vienna Cleaners. The UVB system is currently treating an approximately 1,500 ft2 area of soil in the vicinity of the Vienna Cleaners and will eventually treat an area of approximately 15,000 ft2 when expanded. This system has been operational since March 21, 2001. It is estimated that the system has removed an average of 4 pounds of PCE per operating day, or more than 400 pounds total of PCE since startup. Initial influent PCE concentrations have decreased approximately 30% indicating that the system is working as designed. The system is currently being expanded by EPA's Removal Program to allow it to address a larger area in the vicinity of Vienna Cleaners.

This Removal Action is complementary to the Remedial Action and is incorporated into the overall Site cleanup plan. The Removal Action is designed to reduce the concentrations of PCE in the soil to levels that will not contribute contaminants to ground-water at concentrations above the maximum contaminant level ("MCLs") of 5 ppb. The Removal Action will be operated under the authority of EPA's Removal Program. This allows the Remedial Action to focus on the contamination that is presently already in the aquifer.

The Remedial Action will address the contaminated groundwater. The objective of this action is to prevent current and future exposure to contaminated groundwater through a combination of treatment and containment of the groundwater at the Vienna PCE Site. Through the use of Soil Vapor Extraction along with Air Sparging, this response will permanently reduce the toxicity, mobility, and volume of contaminants in the groundwater.

E. Site Characteristics

1. Conceptual Site Model

a. Potential Migration Pathways

Historical sources of contaminants at the Site are related to past disposal practices at the Vienna Cleaners and the Busy Bee Cleaners. These practices include disposal of spent dry cleaning fluid (PCE) onto the soils surrounding the dry cleaning operations. The resulting soil contamination is being addressed by the Removal Action detailed above. The Removal Action will continue until evaluation of the contaminants in the soils indicates that the soils do not present a source capable of producing groundwater concentrations in excess of the MCLs.

The historical releases, upon entering the soil, likely migrated downward to the ground water surface. The rate of migration would be dependent on the amount and the chemical-physical properties of the constituents released. Once the constituents entered the ground water system, they would be transported downgradient in the ground water. Chemical data collected from the Site indicate that constituents that have migrated to ground water tend to be confined to the shallow portion of the aquifer. While some constituents have been identified in the deeper portion of the aquifer, the concentrations are significantly lower than those in the upper portion.

b. Current and Future Land Use.

According to the City of Vienna WV, the land in the vicinity of the groundwater plume is zoned for residential, private light industrial and commercial businesses. Future land use will likely remain the same.

c. Potential Receptors

Soil

At the Site, there are no known receptors for soil. There is soil contamination being addressed by the Removal Action, however the contamination that is present in the soils resides at a depth of 15 feet or more from the surface, preventing any contact with residents. Further, it is unlikely that any excavation activities would take place below this level, making exposure to construction workers an unlikely possibility.

Ground water

There are no current receptors for ground water exposure scenarios at or near the Site since the groundwater is not used as a private potable source of water. There are two large wells (PW-7 and PW-8) approximately 1400 ft. NW of the plume that are pan of a larger network of eight wells supplying the area with drinking water. There is no evidence of contamination in these wells at this time. There is however, a future risk associated with the groundwater should the plume continue unremediated and enter the drinking water supply through PW-7 and PW-8. Therefore, the future resident using groundwater as a drinking water source is the potential exposure pathway of concern for groundwater.

Basement Gas

Although the contaminated groundwater is 50 feet below the ground surface, there was some concern that this presented a possible exposure pathway through air migrating into basements. This was evaluated by EPA in the Risk Assessment for the Site and it does not appear that exposure to basement gas presents an unacceptable risk.

2. <u>Site Overview</u>

The Site consists of areas impacted by two separate and distinct sources of tetrachloroethene ("PCE"). The sources are Vienna Cleaners and Busy Bee Cleaners (Figure 1). Vienna Cleaners is located at the intersection of 30th Street and 5th Avenue about three blocks from City Hall. The surrounding area consists of single family dwellings and private businesses. Busy Bee Cleaners is situated in a similar setting, located at the intersection of 27th Street and Grand Central Avenue.

The planned Remedial Action is designed to remediate the contaminated aquifer below the City of Vienna. The PCE plume resides primarily in the shallowest zone of the aquifer between 60 and 70 feet below ground surface ("bgs"). Concentrations of PCE found within this plume range from 15,000 parts per billion ("ppb") to 9.3 ppb. Generally, the plume is centered on 29lh Street from 6lh Avenue to the Johns Manville Plant, where sampling in the down gradient direction stopped. This plume is moving in a northwesterly direction with the prevailing groundwater flow towards the Ohio River.

The leading edge of the Vienna Cleaners plume has not been determined. The plume extends approximately 950 ft. from the source area to the southeast edge of the Johns Manville property. The plume is approximately 425 ft wide at the down gradient edge. PCE was not detected in the most down gradient wells, MW-14S/14D, located northwest of Johns Manville.

There is approximately 800 feet between the last down gradient detection (MW-13S/I) of PCE and MW-14S/14D.

A second smaller source of PCE contamination is attributed to the Busy Bee Cleaners location. It extends approximately 675 feet to the northwest. This plume is also moving in a northwesterly direction with the prevailing groundwater flow. The greatest concentration in this particular plume is 150 ppb.

3. <u>Sampling Strategy</u>

Groundwater

The initial challenge presented at the Site was to define the location of the groundwater plume. While some data did exist, there was much uncertainty as to the extent and location of the plume. The initial sampling was accomplished utilizing Cone Penetrometer Technology ("CPT"). This consisted of two 30 ton rigs equipped with a hydraulic jacking system that was used to push the sampling probe through the ground surface. Once the rigs pushed into the groundwater, samples were taken at 10 foot intervals beginning at approximately 55 feet below the ground surface. Samples were taken using a Vertex Cone Sipper. This system allowed samples to be taken at multiple depths using the one boring. The result of utilizing this system was that EPA was able to quickly identify the locations and boundaries of the contaminated groundwater.

Following the identification of the plume boundaries, EPA installed monitoring wells to gather data about the contamination and the underlying aquifer. Forty monitoring wells were installed in 16 locations throughout the Site. Using the CPT data, these wells were optimally placed within the plume and along its leading edge to track the movement of the plume.

In addition to the new wells constructed by EPA, seven existing wells were incorporated into the sampling plans.

To date, EPA has completed 4 rounds of groundwater sampling at the Site gathering over 150 samples.

Soils

Soil contamination concentrations are routinely sampled as part of the ongoing Removal Action. A series of vacuum screens have been installed at depths of 34 to 42 feet. These continuously monitor the soil gas that the UVB system is capturing. In addition, a series of soil borings have been performed in accordance with the planned expansion of the UVB system.

4. <u>Types of Contamination</u>

Ground water

Groundwater in the alluvium of the Ohio River Valley is derived from the infiltration of precipitation and river water. Average annual precipitation in the Ohio River Valley is 39 inches, and is uniformly distributed throughout the year. There is a good hydraulic connectivity between the river and the abutting alluvial strata; the water table fluctuations correspond with changes in the river stage. In the Site area, the water table is approximately 50 feet bgs adjacent to and east of the Ohio River. The aquifer is unconfined and highly transmissive with the median transmissivity of the Ohio River alluvium being 4,800 feet/day ("ft/d")

The groundwater is contaminated with three different compounds requiring remediation. The overwhelming majority of the contaminant residing in the groundwater is PCE with significantly lesser amounts of trichloroethylene ("TCE") and 1,2-dichloroethane. There are two distinct source areas of PCE contamination.

The largest contaminant source is attributed to the Vienna Cleaners location. This PCE plume resides primarily in the shallowest zone of the aquifer between 60 and 70 feet bgs. Concentrations of PCE found within this plume range from 15,000 parts per billion ("ppb") to 9.3 ppb. Generally, the plume is centered on 29th Street from 6lh Avenue to the Johns Manville Plant, where sampling in the down gradient direction stopped. This plume is moving in a northwesterly direction with the prevailing groundwater flow towards the Ohio River (See Figure 3).

The leading edge of the Vienna Cleaners plume has not been determined. The plume extends approximately 950 ft. from the source area to the southeast edge of the Johns Manville property. The plume is approximately 425 ft wide at the down gradient edge. PCE was not detected in the most down gradient wells, MW-14S/14D, located northwest of Johns Manville. There is approximately 800 feet between the last down gradient detection (MW-13S/I) of PCE and MW-14S/14D.

A second smaller source of PCE contamination is attributed to the Busy Bee Cleaners location. It extends approximately 675 feet to the northwest. This plume is also moving in a northwesterly direction with the prevailing groundwater flow. The greatest concentration in this particular plume is 150 ppb.

The data collected as part of the RI did not reveal an area that serves as a continuing source of ground water contamination. The concentration of PCE in the groundwater monitoring well MW-05S, the well closest to the Vienna Cleaners PCE source area has decreased from 8,600 ppb in February 2001, to 4,200 ppb in May of 2002. This indicates that the Removal Action is working as designed and the historical source area is being cleaned.

Soil

PCE is the primary soil contaminant at the Site. During the construction of the UVB system, a continuous core of overburden soil was obtained from the Vienna Cleaners source area. PCE was found in the depth interval of 20 feet to 54 feet bgs in the unsaturated zone and 54 feet to 65 feet in the saturated zone. As noted previously, the Removal Action is successfully cleaning the contamination present in the soils.

F. Current and Future Potential Land and Water Uses.

According to the City of Vienna WV, the land in the vicinity of the groundwater plume is zoned for residential, private light industrial and commercial businesses. Future land use will likely remain the same. Groundwater is used in the vicinity of the Site. Two production wells, (PW-7 and PW-8) are located approximately 1,400 feet northwest of MW-13S, the known leading edge of the PCE plume. The possibility that the PCE contamination will reach these wells in the future presents an unacceptable risk to the residents of Vienna.

G. Summary of Site Risks

A baseline risk assessment was performed to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with the Site assuming no remedial action was taken. The baseline risk assessment is designed to calculate the risks associated with hazardous materials that are not cleaned but simply allowed to remain in place. Since there is an ongoing Removal Action that is addressing the soil contamination at the Site, the risk assessment for the Vienna PCE Site focuses on groundwater and the possible migration of soil gas vapors into residents homes, a byproduct of groundwater contamination.

A streamlined ecological risk assessment was conducted for the Site during the Remedial Investigation. This ecological risk assessment included an analysis of: 1) general environmental setting; 2) constituent fate and transport; 3) potential receptors; 4) complete exposure pathways; and 5) conclusions. The ecological risk assessment concluded that there was no unacceptable risk on the basis of no complete exposure pathways for any of the identified species in the vicinity of the Site. Therefore, the ecological risk assessment supports a decision of no further remedial action, however, the results of the human health risk assessment provides the basis for taking action and identify the contaminants and exposure pathways that need to be addressed by the remedial action.

This section of the ROD summarizes the results of the baseline risk assessment for this Site.

1. Human Health Risk Assessment

a. Identification of Chemicals of Concern

Groundwater

Data from three rounds of sampling were evaluated as part of the Contaminant of Potential Concern ("COPC") selection process. Special focus was put on the concentrations of contaminants found in the shallow wells because the highest levels of contaminants were found in these wells. The shallow well data were used as a basis for COPC screening and for the determination of the exposure point concentrations for the risk calculations. For each compound detected, a set of monitoring wells was selected from the data set to screen for COPCs. This set of monitoring wells was selected based on the level of contaminant present and the proximity of each well to other wells where elevated concentrations were detected. For all the contaminants, the set of monitoring wells used for the COPC selection consisted of wells in the shallow zone of the aquifer. This ensured that the highest level of contaminants would be evaluated for the COPC screening process as well as for the calculation of the 95% upper confidence limit ("UCL") for the exposure point concentration.

Once the wells were identified for each compound, the compounds were screened in accordance with EPA Region Ill's Selection of Exposure Routes and Contaminants of Concern by Risk- Based Screening. The maximum detected concentration of each constituent was compared to the risk-based concentration ("RBC") screening value for tap water to select the COPCs for the media. If the maximum concentration of a constituent exceeded the screening value, the constituent was selected as a COPC and retained for the risk evaluation. Constituents that are essential nutrients (magnesium, calcium, potassium and sodium) were not considered further in the quantitative risk assessment as they are present at low concentrations and are only toxic at very high doses. Twenty-three COPCs were retained for quantitative risk estimation. At the conclusion of the risk assessment, three chemicals were identified as contributing to overall ground water risks and are the Chemicals of Concern (COCs). The COPCs are listed in Table 1 of the Appendix and the COCs are listed in Table 2.

Inhalation Exposure to Vapors in Soil in Residents' Basements

Air modeled concentrations for contaminants from groundwater entering basements were not screened. All volatile organic compounds ("VOCs") detected in the groundwater were retained as COPCs because they have the potential to travel from groundwater to air. Results of the screening process are shown in Standard Table 2.2 of the baseline risk assessment. There are no Chemicals of Concern associated with exposure to vapors from resident's basements.

b. Exposure Assessment

Exposure is defined, for risk assessment purposes, as contact with constituents in environmental media at the outer boundaries of the body, such as the gastrointestinal tract (for ingestion route), skin (for dermal route), and lung (for inhalation route). Exposure assessment is the process of measuring or estimating the intensity, frequency, and duration of human exposure to an agent in the environment. The human health risk assessment evaluated both reasonable maximum exposure ("RME") and Central Tendency ("CT") exposure. The RME is the maximum exposure that is reasonably expected to occur at a site. The CT estimate is intended to approximate the potential exposure to a typical receptor. Exposure Point Concentrations ("EPCs"), which are the concentrations of COPCs in a given medium to which a receptor may be exposed, were also calculated.

Groundwater

The human health risk assessment characterized risks, both current and future, to humans from exposure to contaminants at the Site. As discussed in the Conceptual Site Model, future Site uses are expected to remain as they are today. Receptors for exposure to groundwater include adult and child residents who use tap water from the Vienna municipal supply wells 7 and 8. Note that the municipal supply system blends the water from wells 7 and 8 with other wells in the system. Therefore, the evaluation of exposure to groundwater from wells 7 and 8 is not an accurate representation of the water which residents in the distribution system may use. The conservative evaluation of wells 7 and 8 was conducted assuming wells 7 and 8 were the only wells in the distribution system.

Potential exposures pertain to groundwater which is left untreated and distributed through the Vienna municipal water supply system. Although no one is currently exposed to contaminated groundwater as a drinking water source, the risk assessment evaluated aggregate (child and adult combined for a lifetime exposure) resident, and child resident for future potential exposure to ground water through ingestion, inhalation, and dermal contact. The ground water ingestion rates of 2 liters/day and 1.4 liters/day were used for the adult resident RME and CT receptors, respectively. The ground water ingestion rate for the RME and CT child resident is 1.29 liters/day and 0.74 liters/day. In addition, EPA guidance numbers for skin surface areas for dermal absorption; inhalation rates; and exposure time RMEs and CT were utilized.

Inhalation Exposure to Vapors in Soil in Residents' Basements

Receptors for inhalation exposure to vapors from groundwater from the aquifer include adult and child residents. Vapors may enter residents' basements from transport of contaminants in the vapor phase through soil gas.

For the air modeling of soil vapor entering basements, maximum detected concentrations in groundwater were used in the Johnson and Ettinger model for Subsurface Vapor Intrusion into Buildings (Revised) to calculate estimated indoor air concentration (see Appendix C of the Risk Assessment for results). These estimated indoor air concentrations were used as RME and CT Exposure Point Concentrations ("EPC") values for the current/future exposure to vapors entering residents' basements. Theses concentrations are considered conservative estimates.

c. Toxicity Assessment

The toxicity assessment provides a description of the relationship between a dose of a chemical and the anticipated likelihood of an adverse health effect. The toxicity values describe the quantitative relationship between the level of exposure (dose) to a chemical and the increased likelihood of adverse impacts (response). The intake factors calculated in the exposure assessment were combined with toxicity values and chemical concentrations to estimate a cancer risk or a non-cancer risk.

Key dose-response criteria are EPA cancer slope factors ("CSFs") for assessing cancer risks and EPA-verified reference dose ("RfD") values for evaluating non-cancer effects. Toxicity values are derived from either epidemiological or animal studies, to which uncertainty factors are applied. These uncertainty factors account for variability among individuals, as well as for the use of animal data to predict effects on humans. Sources of these toxicity values are the EPA online database Integrated Risk Information System ("IRIS") and EPA's Health Effects Assessment Summary Tables ("HEAST").

The CSF is multiplied by the estimated daily intake rate of a potential carcinogen to provide an upper- bound estimate of the probability of a response per unit intake of a chemical over a lifetime. CSFs are expressed in units of mg/ kg- day. The upper bound estimate reflects the conservative estimate of risks calculated from the CSF. This approach makes underestimation of the cancer risk unlikely. This chemical- induced risk calculated based on the CSF is in addition to the risk of developing cancer due to other causes over a lifetime. Consequently, the risk estimates in this risk assessment are referred to as incremental or excess lifetime cancer risks.

The chronic Reference Dose (RfD), expressed in units of mg/kg-day, is an estimated daily chemical intake rate for the human population, including sensitive subgroups, that appears to be without appreciable risk of non- carcinogenic effects if ingested over a lifetime. Estimated intakes of COPCs are compared with their RfDs to assess the non- carcinogenic hazards.

Groundwater

Tables 3 and 4 of the Appendix provide a summary of the non-cancer toxicity data for oral/dermal and inhalation exposure to the COPCs in soil. Tables 5 and 6 provide a summary of cancer toxicity data for oral/dermal and inhalation exposure to the COPCs in groundwater.

Inhalation Exposure to Vapors in Soil in Residents' Basements

Tables 3 and 4 also include a summary of the non-cancer toxicity data related to inhalation exposure to vapors in soil. Tables 5 and 6 also provide a summary of cancer toxicity data for contaminants including those associated with potential exposure from vapors in soil.

d. Risk Characterization

The risk characterization process was performed to estimate the likelihood, incidence, and nature of potential effects to human health that may occur as a result of exposure to COPCs at the Site. The quantitative and qualitative results of the data evaluation, exposure, and toxicity assessment sections were combined to calculate risks for cancer and non- cancer health effects. Because of fundamental differences in the mechanisms through which carcinogens and non- carcinogens act, risks were characterized separately for cancer and non-cancer effects.

Carcinogenic Risks

The potential health risks associated with carcinogens were estimated by calculating the increased probability of an individual developing cancer during their lifetime as a result of exposure to a particular contaminant at the Site. The chemical- specific exposure estimates (i.e. average lifetime dose) were multiplied by the chemical and route-specific slope factor, averaged over the expected duration of exposure, to arrive at a unitless measure of probability, expressed numerically (e.g., 1 x 10-4 or 1E-4) of an individual developing cancer as a result of chemical exposure at the Site.

A cancer risk estimate is a probability that is expressed as a fraction less than one. For example, a cancer risk of 1 x 10-4 (IE-4) refers to an upper bound increased chance of one in ten thousand of developing cancer as a result of site-related exposure to a carcinogen over the expected exposure duration. The National Oil and Hazardous Substances Pollution Contingency Plan recommends a target range for excess cancer risk of IE-4 to IE-6 (one in ten thousand to one in a million).

Non-Carcinogenic Hazards

The potential for non-carcinogenic effects due to exposure to a particular chemical is expressed as the hazard quotient ("HQ"). A HQ was calculated by dividing the estimated intake or dose of a chemical by the chemical- specific toxicity value or non-cancer RfD.

Implicit in the HQ is the assumption of a threshold level of exposure below which no adverse effects will occur. If the HQ exceeds one, Site specific exposure exceeds the RfD and the potential for non-cancer adverse effects may exist.

The Hazard Index ("HI") is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g. the liver) within or across those media to which the same individual may reasonably be exposed. A HI less than or equal to one indicates that toxic noncarcinogenic effects are unlikely.

e. Results

Tables 7 and 8 of the Appendix, as well as the discussion below, summarize the cancer and noncancer risk characterization results for groundwater and soil vapors for each exposure scenario evaluated for the Vienna PCE Superfund Site.

<u>Groundwater - Human Health Risk</u>

The Reasonable Maximum Exposure ("RME") estimate for carcinogenic risk is 5 x 10-3 for a hypothetical adult and child exposed to groundwater. The Hazard Index is 38 for a hypothetical adult and 132 for a hypothetical child. Both the carcinogenic risk and the non- carcinogenic risk resulting from exposure to groundwater exceed levels which are considered acceptable, thus warranting remedial action.

These risk estimates for groundwater are based on future reasonable maximum exposure scenarios and were developed by taking into account various conservative assumptions about the frequency and duration of an individual's exposure to the groundwater, as well as the toxicity of the contaminant.

<u>Inhalation Exposure to Vapors from Soil in Residents’ Basements-Human Health Risk</u>

Although the contaminated groundwater is 50 feet below the ground surface, there was some concern that this presented a possible risk. Cancer risks were calculated using a Reasonable Maximum Exposure ("RME") estimate for basement gas. The cancer risk is 2 x 10-6 for a hypothetical adult and 5 x 10-7 for a hypothetical child. The Hazard Index is .02 for both a hypothetical adult and child. Thus, it does not appear that exposure to basement gas presents an unacceptable risk.

2. Ecological Risk Assessment

There were three identified federally endangered species in the vicinity of the Site. They are: the Bald Eagle, the Pink Mucket Pearly Mussel, and the Fanshell Mussel. As detailed below, the contaminants present in the groundwater below the Site are not reaching the Ohio River at this time. Therefore it is reasonable to conclude that the Site presents no adverse impact to the federally endangered species in the vicinity.

The potential for Site contaminants to reach the Ohio River has been evaluated. The PCE plume is moving in a north-westerly direction. The only potentially viable route that ecological receptors may be exposed to site contaminants is through exposure to any contaminated groundwater that may be discharged to the Ohio River. Currently there are two monitoring wells (MW-14 and the Johns Manville production well) located between the known location of the plume and the Ohio River. These wells have returned non-detects for contaminants in all 4 of the sampling rounds that have been completed to date. In addition, EPA conducted additional investigatory work around the perimeter of the Johns Manville plant. The Cone Pentrometer Testing that was performed during April of 2002 indicated that no PCE is currently present on the Northwesterly and Southwesterly sides of the plant. Based on this information we can reasonably conclude that the plume is not currently reaching the Ohio River.

It is anticipated that the Selected Remedy will successfully clean up the plume prior to it ever reaching the Ohio River.

H. Remedial Action Objectives

Based on information relating to types of contaminants, environmental media of concern, and potential exposure pathways, Remedial Action Objectives (RAOs) were developed to aid in the development and screening of alternatives. These RAOs were developed to mitigate, restore, and/or prevent existing and future potential threats to human health and the environment. The RAOs' for the selected remedy for the Vienna PCE Superfund Site are as follows:

1. Reduce concentrations of Chemicals of Concern ("COC") in groundwater to levels which result in less than or equal to a 1 x 10-5 cumulative excess cancer risk and a Hazard Index less than 1.0 and achieve drinking water standards (MCLs). Successfully achieving the cumulative excess cancer risk goal will result in concentrations for each COC decreasing at least to its respective MCL of 5 ppb.

2. Prevent/ minimize human exposure, including ingestion, inhalation, and dermal contact by current and future residents and industrial workers to contaminated groundwater.

3. Minimize the migration of contaminated groundwater into the Ohio River through treatment to achieve risk based levels identified in RAO 1 above.

I. Description of Alternatives

Several remedial alternatives were developed to deal with the risks presented by the Vienna PCE Site. The alternatives are summarized below. The numbers associated with each alternative correspond to those in the FS report.

Common Element

With the exception of Alternative 1, all of the alternatives were developed assuming the continued operation of the Unterdruck Verdamfer Brunner system described above. This system will remain operational under EPA's Removal Program until the levels of PCE in the soil no longer contribute contamination to the groundwater at levels above the MCL of 5 ppb. In addition to reducing soil contaminant levels that will result in achievement of the MCL for PCE, all of the remedies require institutional controls to ensure that no one uses the contaminated groundwater for potable or hygienic uses such as drinking, bathing, or cooking at the Site until clean- up levels are achieved. These institutional controls will be implemented through zoning restrictions, County Ordinances or City Ordinances. Figure 4 in the Appendix depicts the area where such institutional controls are needed to protect public health and the environment. Consistent with expectations set out in Superfund regulations, none of the remedies rely exclusively on institutional controls to achieve protectiveness. Monitoring to ensure the effectiveness of the remedy, as well as institutional controls is a component of each alternative except the "no-action" alternative.

Alternative 1: No Action

Estimated Capital Cost: $0
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $0
Estimated Construction Time Frame: N/A
Estimated Time to Achieve RAOs: hundreds of years

Regulations governing the Superfund program generally require that the " no action" alternative be evaluated to establish a baseline for comparison. Under this alternative, EPA would take no action at the Site to prevent exposure to the groundwater contamination.

Alternative 2: Relocation of Public Water Supply Wells

Estimated Capital Cost: $1,091,000 **1**
Estimated Annual O&M Cost: $41,400
Estimated Present Worth Cost: $1,605,000
Estimated Construction Time Frame: 1 year
Estimated Time to Achieve RAOs: hundreds of years

This alternative would include limited action for protection of two public drinking water supply wells. This includes the closure and abandonment of two existing public drinking water supply wells, currently located along River Road between 32nd and 34th Streets, approximately 2,000 feet from the Vienna Cleaners source area, and approximately 650 feet north of the Johns Manville plant.

Project elements included in this alternative include the abandonment of the current drinking water supply wells, demolition of the pump house adjacent to the wells, drilling and installation of two new drinking water supply wells and a production well pump, construction of an associated pump house, construction of a new pipeline and connections from the new wells/ pump house to the existing City of Vienna water distribution system. The two new wells which would replace PW-V7 and PW-V8 would be sited in an uncontaminated portion of the aquifer, and would be strategically located for inclusion in the water distribution system.

This alternative would also include groundwater use restrictions such as restrictions on the placement of new drinking water wells and the abandonment of any existing private water wells as well as long-term groundwater monitoring to track the migration of the plume and to verify that drinking water quality standards are being met by the two newly placed wells.

Alternative 3: In Situ Permeable Reactive Barrier

Estimated Capital Cost: $5,287,000
Estimated Annual O&M Costs: $255,700
Estimated Present Worth Cost: $8,460,000
Estimated Construction Time Frame: 1 to 2 years
Estimated Time to Achieve RAOs: hundreds of years

The in situ permeable reactive barrier ("PRB") would include the installation of a funnel and gate system using a slurry wall down gradient of the two contaminant plumes to direct groundwater toward a reactive zone wall for treatment. The reactive material would include a treatment zone consisting of zero valent iron to degrade the PCE to carbon dioxide and chloride ions.

The contaminated groundwater would flow through the treatment gate under naturally occurring hydraulic conditions eventually migrating to the Ohio River. This Alternative would also include groundwater use restrictions and periodic groundwater monitoring to track the migration of the plume and to verity that groundwater quality standards are met.

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1 The discount rate used to calculate the present worth cost for all of the Alternatives developed for this Site was 7%

Alternative 4: In Situ Chemical Oxidation with Air Sparging/Soil Vapor Extraction

Estimated Capital Cost: $5,222,000
Estimated Annual O&M Cost: $76,100
Estimated Present Worth Cost: $6,165,000
Estimated Construction Time Frame: 6 months to 1 year
Estimated Time to Achieve RAOs: 5 to 10 years

In situ chemical oxidation involves the injection of a reactive material such as hydrogen peroxide that oxidizes the chlorinated organic compounds (in this case PCE) in the groundwater to carbon dioxide, chloride ions, and water. Injection wells will be constructed in a grid pattern within the most highly contaminated portion of the plume to reduce contaminant levels. Injection points would be installed vertically to provide efficient dispersal of reagents over the entire depth of contamination (50 to 80 feet below grade surface ("BGS"))- This alternative would include the placement of a line of air sparging and soil vapor extraction wells (sparge curtain) on the down gradient side of the contaminant plume to prevent the further migration of contaminated groundwater not treated by the in situ chemical oxidation process. This remedy will also include groundwater use restrictions and periodic short- term groundwater monitoring to track the migration of the plume and to verify that groundwater quality standards are met.

Alternative 5: In Situ Air Sparging with Soil Vapor Extraction

Estimated Capital Cost: $2,910,000
Estimated Annual O&M Cost: $162,900
Estimated Present Worth Cost: $4,931,000
Estimated Construction Time Frame: 1 year
Estimated time to Achieve RAOs: 5 to 10 years

This alternative would include the installation of air sparging wells within the central portion of the two plumes and the down gradient edge of the plume to remove chlorinated organic compounds from the groundwater. Air sparging would be used to inject air into the groundwater contaminant zone to volatilize and remove the PCE from the groundwater. The PCE stripped from the groundwater would then rise along with the air into the unsaturated zone where it would be captured by soil vapor extraction ("SVE") techniques. This system would employ a number of air sparging wells aligned in a grid pattern, with SVE wells placed among the sparge wells to draw in the volatized organic contaminants.

SVE wells would be installed above the water table to remove the PCE from the soil. A vacuum would be applied to the extraction wells to extract the vapor containing PCE. An off gas treatment system using vapor phase carbon adsorption may be necessary to comply with Clean Air Act standards associated with the release of contaminants to the surrounding air. The need for the system will be determined during pilot testing. The estimated costs above include the cost for the off gas treatment system. This alternative would also include groundwater use restrictions and groundwater monitoring to track the migration of the plume and to verify that treatment standards are met.

Alternative 6: Groundwater Extraction and Treatment Using Air Stripping and Carbon Adsorption

Estimated Capital Costs: $4,707,000
Estimated Annual O&M Costs: $273,500
Estimated Present Worth Cost: $8,101,000
Estimated Construction Time Frame: 6 months to 1 year
Estimated Time to Achieve RAOs: 50 to 100 years

Under this alternative, extraction of contaminated groundwater would be accomplished using wells installed within the central portion of the two plumes to capture the most highly contaminated groundwater. In order to control the migration of the contaminant plume, it is expected that relatively high pumping rates would be required given the large amounts of water contained within the aquifer. Treatment of extracted groundwater would be accomplished using air stripping with carbon adsorption to serve as a polishing step. In addition, a pre-treatment step may be necessary using filtration to remove suspended solids, and a vapor phase carbon system may be necessary to meet Federal Clean Air Act standards for emissions of PCE. The necessity of both of these steps will be determined in pilot testing. The treated groundwater would be transported via discharge pipes installed from the treatment plant area to the Ohio River in the vicinity of the Johns Manville plant. This alternative also includes groundwater use restrictions and groundwater monitoring to track the migration of the plume and to verify that treatment standards are met.

J. Summary of Comparative Analysis of Alternatives

Section 121(b)(l) of CERCLA presents several factors that at a minimum EPA is required to consider in its assessment of alternatives. Building upon these specific statutory mandates, the NCP articulates nine evaluation criteria to be used in assessing the individual remedial alternatives.

A detailed analysis of the alternatives was performed using the nine evaluation criteria in order to select a Site remedy. The following is a summary of the comparison of each alternative's strengths and weaknesses with respect to the nine evaluation criteria. These nine criteria are summarized as follows:

<u>Threshold Criteria</u>

The two threshold criteria described below must be met in order for an alternative to be eligible for selection in accordance with the NCP:

1. **Overall protection of human health and the environment** addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

2. **Compliance with applicable or relevant and appropriate requirements ("ARARs")** addresses whether or not a remedy will meet all Federal environmental and more stringent State environmental and facility siting standards, requirements, criteria and limitations, unless ARARs are waived under CERCLA § 121(d)(4).

<u>Primary Balancing Criteria</u>

The following five criteria are utilized to compare and evaluate the elements of one alternative to another that meet the threshold criteria:

3. **Long-term effectiveness and permanence** addresses the criteria that are utilized to assess alternatives for the long-term effectiveness and permanence they afford, along with the degree of certainty that they will prove successful.

4. **Reduction of toxicity, mobility, or volume through treatment** refers to the anticipated performance of the treatment technologies that may be included as part of the remedy.

5. **Short term effectiveness** addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved.

6. **Implementability** addresses the ease or difficulty of implementing the alternatives including consideration of the technical and administrative feasibility of a remedy, and the availability of materials and services needed to implement a particular option.

7. **Cost** includes estimated capital and operation and maintenance ("O&M") costs, as well as present-worth costs.

Modifying Criteria

The modifying criteria are used as the final evaluation of remedial alternatives, generally after EPA has received public comment on the RI/ FS and Proposed Plan:

8. **State acceptance** addresses the State's position and key concerns related to the preferred alternative and other alternatives, and the State's comments on ARARs or the proposed use of waivers.

9. **Community acceptance** addresses the public's general response to the alternatives described in the Proposed Plan and the RI/FS report.

Following the detailed analysis of each individual alternative, a comparative analysis, focusing on the relative performance of each alternative against the nine criteria, was conducted.

Threshold Criteria

1. Overall Protection of Human Health and the Environment

Alternative 1, the no action alternative, provides no protection against possible exposure to contaminated groundwater, which will continue to be a source for migration of contaminants that could eventually reach the nearby City of Vienna public water supply wells (PW-V7 and PW-V8) and the Ohio River. Alternative 2, relocation of the public water supply wells, is protective of human health but does not address any environmental concerns since there is no action taking place to mitigate the contaminants in the groundwater. Since neither of these two alternatives satisfy the threshold criterion of providing protection of human health and the environment, they will be omitted from consideration and not discussed further in this evaluation.

Alternatives 3, 4, 5, and 6 provide a high degree of protection to both human health and the environment by removing and/ or treating contaminated groundwater at the Site, which minimizes the potential for further migration. Alternatives 3, 4, and 5, the permeable reactive wall, chemical oxidation with air sparging/SVE, and air sparging/SVE alternatives respectively, are in situ treatment approaches, while Alternative 6 relies on groundwater extraction and treatment. Alternative 3 provides treatment by dechlorinating contaminants in the groundwater on the down gradient edge of the plume west of the Johns Manville plant. Alternatives 4 and 5 should be more effective in contacting all of the contaminants and would achieve clean up standards in the shortest period of time. Alternative 6 is expected to impact the entire groundwater plume, but relies on diffusion of contaminants to the extraction wells which has been shown to be a slow process at other sites and would require many years to reach clean up standards.

Alternatives 4 and 5 were determined to have the highest overall protectiveness with Alternatives 3 and 6 ranked as medium to highly protective.

2. Compliance with ARARs

ARARs are promulgated, enforceable federal environmental or public health requirements, and such state standards that are more stringent than federal standards, that a remedy must attain unless waived. Applicable requirements are those clean up standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a Superfund site. Relevant and appropriate requirements, while not legally applicable at a Superfund site, address problems or situations sufficiently similar to those encountered at the Superfund site such that their use is well suited to the particular site or actions at the site.

Alternatives 3,4,5, and 6 are expected to comply with all chemical, location and action-specific ARARs. These will include surface water quality criteria, groundwater MCLs, and air emission standards during remedial activities.

For a detailed listing of ARARs associated with the Selected Remedy for the Vienna PCE Site, please see tables 9, 10 and 11 located in the Appendix.

Primary Balancing Criteria

3. Long Term Effectiveness and Permanence

Alternatives 3,4,5 and 6 are all effective in treating contaminants over the long- term, with Alternatives 4 and 5 expected to achieve clean up levels in the shortest period of time. All four of the treatment alternatives will require regular maintenance for effective groundwater treatment to be attained. Alternative 3 will effectively treat contaminants, but will require the reactive media to be replaced with new zero-valent iron approximately every ten years. The structure of the funnel portion of the Permeable Reactive Barrier is a permanent subsurface structure. Alternatives 4 and 5 are based upon injection of material or the sparging of air to strip contaminants from the groundwater. Alternative 4 may require multiple injections of oxidation material depending on the effectiveness of the first application of the oxidants. Alternative 6 would require the operation and maintenance of the groundwater treatment plant equipment over the course of the cleanup.

Alternative 4 was the best ranked treatment in this category due to this Alternative's ability to destroy organic contamination in situ. Alternatives 3, 5, and 6 were equally ranked slightly below with a medium to high score.

4. Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives 3, 4, 5, and 6 all utilize various active and in situ treatment methods to reduce the toxicity, mobility, or volume of contaminants in the groundwater.

Alternatives 3 and 4 will both reduce toxicity and volume of contaminants but will not effect contaminant mobility. Alternative 3, the permeable reactive barrier, reduces the toxicity and volume of contaminants in groundwater as they pass through the treatment area which dechlorinates organic contaminants. Alternative 4 will destroy organic contaminants in the groundwater via the injection of oxidizing chemicals into the aquifer, which will substantially reduce the toxicity and volume of the contaminants, but will not affect mobility. The air sparging/SVE curtain component of Alternative 4 will also reduce the toxicity and volume of contaminants in the groundwater.

The air sparging/SVE process of Alternative 5 reduces the toxicity of the contaminants by removing and treating the contaminants in the vapor phase carbon unit. This alternative will also affect the mobility of the contaminants as a result of the hydrological effects of the sparging process. The volume of contaminants in the aquifer will be reduced due to volatization, and the subsequent vapor extraction of volatile groundwater contaminants.

Alternative 6 will reduce the mobility and volume of the contaminants by extracting groundwater from the aquifer for treatment. The toxicity of the contaminants will be reduced following destruction of the vapor phase carbon which will be employed as part of the air stripper.

Alternatives 3 and 4 were both ranked high in this criteria subcategory due to their ability to reduce toxicity and volume of contaminants in groundwater. Alternatives 5 and 6 were slightly below and ranked medium to high for this criteria.

5. Short-term Effectiveness

Alternative 3, due to the length of the excavation, has the highest potential for short-term impacts due to the construction of a continuous slurry wall in a city setting. There is also a potential for worker injury due to equipment required to install the funnel and gate walls. Alternatives 4, 5, and 6 all have similar potential short-term impacts. Alternative 4, with its injection process, has a relatively limited short-term exposure potential. Alternatives 5 and 6 have moderate levels of impact to local residents during well installation, with Alternative 5 having significantly more well installation events than Alternative 6.

Alternatives 4, 5, and 6 were scored equally effective, slightly above Alternative 3 in the medium to high effectiveness range.

6. Implementability

The materials, equipment, and personnel for Alternative 3 are available. Although the construction of the slurry wall and subsurface treatment areas uses relatively common techniques, the installation of this material to a depth of 90 feet will be difficult to implement. It will also require installation along city roads and would have impacts to utilities.

Alternatives 4, 5, and 6 would present implementability issues during the installation of injection points or wells close to houses and industrial buildings, and transfer piping will need to be constructed within areas where utilities are present. There are also additional implementability issues related to Alternative 4. Several vendors provide oxidation material, but currently there are relatively few vendors and they have proprietary formulations. This may lead to procurement issues as compared to a treatment based on off-the-shelf materials. While the injection process being proposed is not unusual, the precision of the placement of the injection point is critical. As a result, the successful implementation of Alternative 4 will depend on the proper formulation of oxidation materials as well as aim (the precise placement of the injection mechanism, in three dimensions, relative to the areas of contamination). Another issue associated with Alternative 4 is that given the density of building footprints, access to the proper injection point may not be available, thus impacting the effectiveness of the alternative.

Alternative 5 is similar to Alternative 4 in that since the location of the sparging and extraction wells are based upon a grid due to zones of influence, there may be accessibility issues associated with installation of the wells at the proper locations. The sparging and extraction wells use common drilling techniques for their installation, with specialized equipment for pumping air into the formation and extracting vapor from above the aquifer.

The groundwater treatment proposed in Alternative 6 relies on proven technologies and would be readily implementable.

Alternatives 5 and 6 scored the highest with respect to implementabiliy. Alternative 4 was ranked at a medium level being fairly difficult to implement and Alternative 3 was ranked low due to the greater difficulty of constructing this remedy.

7. Cost

The following table lists the total present worth cost of each of the alternatives which satisfied the threshold criteria. The present worth cost includes both the capital cost and an estimate of the value of the total operation and maintenance costs for each alternative.

ALTERNATIVE	COST (present worth)
(3) In Situ Permeable Reactive Barrier	$8,460,000
(4) In Situ Chemical Oxidation with Air Sparging/SVE	$6,165,000
(5) In Situ Air Sparging with Soil Vapor Extraction	$4,931,000
(6) Groundwater Extraction and Treatment using Air Stripping and Carbon Adsorption	$8,101,000

Alternative 3 is estimated to be the most costly remedy due mainly to the high capital costs associated with constructing this Alternative. Alternative 4 is projected to cost $6,165,000, with the number of injection points driving the cost of the alternative. Alternative 5 will cost $4,931,000 and is the least costly Alternative. Alternative 6 will cost $8,101,000, with the costs more evenly split between the capital costs and the O&M costs.

8. State/Support Agency Acceptance

The State of West Virginia supports the Selected Alternative.

9. Community Acceptance

Comments received during the public comment period were generally supportive of EPA's recommendations for remediation. Specific comments on the Proposed Plan are addressed in detail in the Responsiveness Summary which is a part of this ROD.

K. Principal Threat Wastes

There are no principal threat wastes in the soil or in the ground water at the Vienna PCE Superfund Site.

L. Selected Remedy

1. Summary of the Rationale for the Selected Remedy

Based on consideration of the CERCLA requirements and analysis of alternatives using the nine evaluation criteria, including public comments, EPA has determined that the following alternative constitutes the most appropriate remedy for the Vienna PCE Superfund Site. This selected remedy for Vienna PCE is the preferred alternative that was identified in the Proposed Plan. The selected remedy is Alternative 5: In Situ Air Sparging with Soil Vapor Extraction combined with achievement of soil cleanup levels contributing no more than 5ppb of PCE to groundwater in the vicinity of Vienna Cleaners as well as institutional controls, as further described below.

The selected remedy provides the best balance among the nine criteria that are necessary for a Superfund Remedy selection. The remedy is more easily implementable and able to be constructed in public right of ways since the plume migration route is primarily along 29Ih Street in Vienna. It is the least costly of the four viable alternatives and is based on technology that is similar to that which is successfully cleaning the source area as detailed on page 5. It provides for timely achievement of the Remedial Action Objectives and the ability to attain permanent reduction of Chemicals of Concern.

2. Description of Remedial Components

The three main components of the selected remedy along with their respective performance standards are summarized below:

A. Groundwater

In Situ Air Sparging with Soil Vapor Extraction will include the installation of air sparging wells within the central portion of the two plumes and the down gradient edge of the plume to remove chlorinated organic compounds from the groundwater . Air sparging would be used to inject air into the groundwater contaminant zone to volatilize and remove the PCE from the groundwater. The PCE stripped from the groundwater would then rise along with the air into the unsaturated zone where it would be captured by soil vapor extraction ("SVE") techniques. This system would employ a number of air sparging wells aligned in a grid pattern, with SVE wells placed among the sparge wells to draw in the volatized organic contaminants (See Figure 5 in the Appendix for a conceptual diagram of this remedy).

Field pilot studies will be necessary to adequately design and evaluate the system. The most important design parameter to be considered for the air sparging system is the radius of influence. This is the greatest distance from an air sparging well at which sufficient sparge pressure and airflow can be induced to enhance the mass transfer of contaminants from the aqueous phase to the vapor phase. The radius of influence will determine the number and spacing of the sparging wells, with an overlap in their radii of influence so that the contamination area is covered. The sparging air flow rate required to provide sufficient air flow to enhance the mass transfer is site-specific and will be determined during the pilot test phase.

The additional field data to be collected will determine the number and location of sparging and extraction wells to capture the contaminated ground water and the number and location of any additional performance monitoring wells if necessary. For cost estimation purposes, the air sparging with soil vapor extraction system was assumed to consist of 64 sparging wells and 22 extraction wells that would operate for approximately 10 years.

In addition to the wells, an off-gas treatment station will be constructed to minimize the potential for uncontrolled releases of contaminated vapors to the atmosphere and ensure the remedy complies with Clean Air Act standards. This treatment step is necessary given the high PCE concentrations and the proximity of homes and industrial buildings.

A groundwater monitoring and sampling plan will be developed by EPA in conjunction with the design of the air sparging and soil vapor extraction system. The monitoring plan will include, but not be limited to provisions to track the migration of the PCE plume as well as gather information that will enable EPA to optimize the design of the selected remedy. Groundwater monitoring will continue until it has been demonstrated that Remedial Action Objective 1 has been met.

B. Soils

Soils in the vicinity of the Vienna Cleaners property are contaminated at depth. There is an ongoing EPA Removal Action which is providing treatment for these soils using the Unterdruck Verdamfer Brunner system. This system is currently treating an area of about 1,500 ft2 of soil and will eventually treat an area of about 15,000 ft2. This system will remain operational until the levels of PCE in the soil no longer contribute contamination to the groundwater at levels above the MCL of 5ppb.

The monitoring plan for the Site will incorporate information on the cleanup of these soils as it is crucial to the overall success of the selected remedy.

The costs associated with this system are not included in the estimate of the Remedial Action costs due to the separate nature of the programs and the fact that funds for the expansion have already been allocated to the Removal Program.

C. Institutional Controls

To ensure that there is no human consumption or adverse exposure to groundwater prior to the successful completion of this remedial action, institutional controls will be implemented to ensure that no one uses the groundwater for potable or hygienic uses such as drinking, bathing, or cooking at the Site until clean-up levels are achieved.

These institutional controls will be implemented through zoning restrictions, County Ordinances or City Ordinances enacted by the local municipalities which will prohibit the placement of wells which provide water for such uses in the vicinity of the Site. Figure 4 of the Appendix depicts the area where such institutional controls are needed to protect public health and the environment.

Performance Standards for each component of the Selected Remedy:

a. <u>Ground water:</u>

Chemicals of Concern ("COCs") in groundwater will be reduced to levels which result in less than or equal to a 1 x 10-5 cumulative excess cancer risk and a Hazard Index less than 1.0 and achieve drinking water standards (MCLs). Successfully achieving the cumulative excess cancer risk goal will result in concentrations for each COC decreasing at least to its respective MCL of 5 ppb. This will be accomplished through the operation of the Air Sparging with Soil Vapor Extraction system. This system will remain operational until Remedial Action Objective 1 is met.

b. <u>Soils</u>:

Soils in the vicinity of the Vienna Cleaners property will be treated until they no longer contribute PCE contamination to the groundwater at levels above the MCL of 5 ppb. This treatment will be accomplished using the UVB system, under EPA's ongoing Removal Action.

c. <u>Institutional Controls</u>:

Groundwater within the area identified on Figure 4 shall not be used for potable or hygienic uses. Local ordinances or other mechanisms shall be used to achieve this standard. Periodic monitoring to ensure the effectiveness of the institutional controls shall be performed.

3. Summary of the Estimated Remedy Costs

The information in this cost estimate summary is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or a ROD amendment. This is an order of magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost. The estimated capital costs of the Air Sparging with Soil Vapor Extraction remedy is $2,910,000. The net present worth cost of O&M costs projected over 30 years is $2,020,956. Thus the net present worth cost of the selected remedy is $4,931,406. Please see Table 12 of the Appendix for a detailed cost breakdown.

4. Expected Outcome of The Selected Remedy

Although the ongoing removal action is removing the primary sources of ground water contamination, it is still anticipated that it will take approximately 5 to 10 years before cleanup levels specified for the ground water are achieved. During this period, institutional controls will prevent exposure to the contaminated ground water. The primary expected outcome of the selected remedy is that ground water will no longer present an unacceptable risk to future users of the ground water via ingestion and inhalation. This will allow the City of Vienna to have more flexibility in deciding where to place new or replacement water supply wells.

M. Statutory Determinations

The remedial action selected for implementation for the Vienna PCE Superfund Site is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, will comply with ARARs and is cost effective. The following information identifies each statutory requirement and describes how the remedy meets the requirement.

1. Protection of Human Health and Environment

Groundwater

The selected remedy will protect human health by controlling exposures to human receptors through treatment, engineering controls, and institutional controls. The selected remedy will utilize air sparging and soil vapor extraction throughout the contaminated groundwater plume to achieve cleanup levels. Institutional controls will be implemented to prevent the use of ground water until the cleanup levels are achieved. A benefit of utilizing an In Situ remedy is that the entire plume will be treated to drinking water standards. This will prevent the migration of contaminated groundwater to the Ohio River, thus reducing exposure to ecological receptors.

Soils

The selected remedy will protect human health by controlling exposure to human receptors through the treatment of contaminated soil. The reduction of contaminants in the soil decreases the amount of contamination that may migrate to the aquifer.

2. Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy will comply with all federal and any more stringent state ARARs that pertain to the Site. In particular, the remedy will comply with the ARARs listed on Tables 9 thru 11 in the Appendix.

Cost Effectiveness

In Situ Air Sparging with Soil Vapor Extraction is the least costly of the alternatives which satisfied the threshold criteria of being protective of human health and the environment.

Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Possible

The selected remedy for ground water consists of an In Situ Air Sparging with Soil Vapor Extraction system which is a permanent solution. It is also considered an alternative technology for groundwater. Due to the small number of COCs, the EPA is able to utilize a system tailored to the contaminants in question. In addition, the success of the currently ongoing Removal Action that is utilizing a similar technology lends a degree of confidence to this alternative remedy. The selected remedy provides the best balance of trade-offs among the alternatives with respect to the balancing criteria set forth in the NCP.

Preference for Treatment as a Principal Element

The principal element of the selected remedy is the In Situ treatment of groundwater and the extraction of contaminated vapors from the aquifer. The selected remedy satisfies the statutory preference for treatment as a principal element.

Five-Year Reviews of the Selected Remedy are Required

The NCP requires a five-year review if the remedial action results in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure. This review evaluates whether a remedy currently is, or will be, protective of human health and the environment. A policy five-year review is required for the Vienna PCE Superfund Site because it is estimated that it will take up to 10 years to remediate the ground water. The first five-year review will be conducted five years from the selected remedy's completed construction.

N. Documentation of Significant Changes

The Proposed Plan for the Vienna PCE remedy was released for public comment on July 15, 2002. The Proposed Plan presented six remedial action alternatives for the groundwater contamination. EPA proposed: Alternative 5, In Situ Air Sparging with Soil Vapor Extraction.

EPA reviewed all written and oral comments submitted during the public comment period. The comments generally expressed support for the EPA preferred alternative. Thus there were no significant changes made to the remedy identified in the Proposed Plan.

III. Responsiveness Summary

The public comment period on the Proposed Plan for the Vienna PCE Superfund Site was held from July 15, 2002 to August 13, 2002. Comments received during this time are summarized below. Section A addresses those comments generated during the public meeting on July 24, 2002. The agency also received written and electronic comments which are addressed in Section B.

A. Summary of Major Issues and Concerns Raised by the Public during the July 24, 2002 Public Meeting.

A. A citizen asked when the time frame calling for 5 to 10 years to reach the remedial cleanup goals of the preferred remedy begins.

EPA Response: The time frame to reach remedial action goals begins when the selected remedy is completely constructed and active. In this case that would be approximately two years from the date of this Record of Decision.

A.2 A citizen asked where the plant that houses the necessary equipment required for the preferred remedy would be located.

EPA Response: The exact location of the plant will be determined during the Remedial Design. EPA will inform the public of the location of the all components after the Remedial Design is completed.

A.3 A citizen asked how the selected remedy would affect residential property values.

EPA Response: While EPA cannot predict the future value of real estate, removing the contamination beneath residential homes and ultimately removing the Site from the National Priorities List should have a positive impact on the community.

A.4 A citizen asked if EPA will continue to monitor the groundwater plume beneath Vienna, specifically in the areas close to municipal supply wells 7 and 8.

EPA Response: Yes, EPA plans to continue monitoring in Vienna. The next round of sampling is scheduled for November of 2002. The Record of Decision contains specific provisions detailing the need for a monitoring/ sampling plan which will detail the future intervals of sampling at various stages of the project.

A.5 A citizen asked why there is no mention of vinyl chloride contamination.

EPA Response: Vinyl chloride is a known breakdown product of PCE, however the conditions in Vienna do not appear to be conducive to the breakdown of PCE. EPA did not find any evidence of vinyl chloride contamination during the four rounds of groundwater sampling it conducted.

A.6 A citizen asked if the pumps and associated equipment to run the preferred remedy would be excessively noisy.

EPA Response: EPA does not anticipate that there will be excessive noise from the system. Every effort will be made during the Remedial Design to minimize noise impacts.

A.7 A citizen asked if funding for the project is available.

EPA Response: Funding for the Remedial Design will be available shortly after the Record of Decision is issued. Once the Design is completed, EPA Region 3 will have to solicit Remedial Action funding from the Superfund National Prioritization Panel. This project will have to compete with other fund- lead projects nationwide to receive funding. While there is no guarantee the Remedial Action funding will be immediately available, no Region 3 Superfund projects to date have been delayed due to lack of funding.

A.8 A citizen asked if the groundwater plume was moving in the direction of municipal wells 7 and 8.

EPA Response: At this time no. However numerous models predict that municipal wells 7 and 8 will eventually influence the groundwater plume and begin to draw contamination towards those wells.

A.9 A citizen asked if the preferred remedy consisted of drilling new wells or would they use existing wells.

EPA Response: The project will require new wells to be constructed. The existing wells will be used for monitoring purposes.

A.10 A citizen asked exactly where the system will be constructed.

EPA Response: This will be determined during the Remedial Design. Figure 5 represents our current conceptual layout but will likely be modified. EPA intends to keep citizens informed of the proposed location of the system when the planned design is completed.

A.11 A citizen asked what the consequences of not cleaning up the contaminated groundwater would be to the town of Vienna.

EPA Response: Not cleaning the groundwater presents an unacceptable risk to the residents of Vienna and would likely eventually result in a greater number of cancer and non-cancer health diseases in Vienna if contaminated groundwater were to be used as drinking water.

A.12 Craig Metz, Director of Public Works, City of Vienna: Mr Metz requested assistance from EPA to remove the existing six municipal wells that have been decommissioned from service as a result of the PCE contamination.

EPA Response: EPA will evaluate the need to remove the existing decommissioned municipal wells during the Remedial Design,

A.13 A citizen stated that as a resident living adjacent to the Vienna Cleaners and the existing Removal Action equipment building, she was not happy with the circumstances of living so close to a Superfund Site. However, she stated that she was certainly happy that the Site is being cleaned and furthermore commented on the noise factor stating that as far as noise there is not any, the system is right off her back porch, the people working on the site have been courteous and kind and there's no problem with noise.

EPA Response: EPA appreciates your support and looks forward to continue working with the residents to assure a successful conclusion to the project.

A.14 David Nohe, Mayor of Vienna, expressed his appreciation for EPA's efforts to install additional monitoring wells in the vicinity of the City's production wells (number 7 and 8). EPA's quick response provided the City with more confidence in EPA and the sense that EPA really did care about the residents of Vienna.

EPA Response: EPA appreciates the Mayor's continued support.

B. Summary of Major Written and Electronic Comments Received During the Public Comment Period

B.1 One citizen commented that the placement of the air sparging wells needed to be optimized to protect the municipal water supply wells.

EPA Response: EPA agrees and this issue will be addressed in the Remedial Design.

B.2 The same citizen commented that additional wells are needed to further refine the flow models, monitor the plume and optimize the placement of air sparging wells.

EPA Response: The need for additional wells or any other type of sampling efforts will be determined during the Remedial Design.

B.3 A citizen commented that the extent and of number of wells associated with the remedy appeared to be unnecessary.

EPA Response: The number, extent and location of all Remedial Action components will be determined during the Remedial Design.

B.4 A citizen wrote: On page 3 (of the Proposed Plan), describing the operation of the UVB system, it would be desirable to compare the estimated removal rate and progress so far (average 4 pounds PCE per day, total 400 pounds PCE - the better part of a 55 gallon drum - since startup) with the estimated total amounts of PCE in the soil and in the groundwater (tiny by comparison). The reader will therefore get a much clearer sense of the importance of "hot spot" remediation, focused on the Vienna Cleaners which is clearly the major source.

EPA Response: At this time EPA is uncertain as to the total amounts of PCE remaining in the soils and aquifer of Vienna. While the 400 pounds of PCE removed thus far seems impressive, it is the result of only one operating UVB well, plans call for an additional 4 to 7 to be installed. EPA does agree that remediation of the "hot spot" is of utmost importance. This is why the first efforts in Vienna concentrated on removing this source material. The Remedial Investigation however, details contamination that has migrated much further than this small source area and it is this groundwater contamination that is the primary focus of the Selected Remedy.

B.5 A citizen wrote: The current treatment area of 1500 ft2, assuming it is roughly circular, is approximately 44 feet in diameter..... which seems large enough to cover the likely soil source area. If the UVB system is now positioned at the center of the spot(s) where PCE was historically spilled, then it seems unlikely that there will be a need for a larger system (15000 ft2 would be a 140 foot diameter circle). Are there soil data which show that the larger system is necessary? If so, some mention of the areal extent would be helpful; if not, perhaps the UVB expansion should be made contingent upon further data.

EPA Response: The rationale for the above referenced expansion of the UVB system is repeated below and is taken from the EPA's "*Request for a ceiling increase and $2 million exemption for a Removal Action* " dated September 26, 2001

> "The pilot UVB system has demonstrated success in removing an estimated 4 pounds of PCE per day since its startup in March 2001. The radius of influence for the pilot system is estimated to be 20- 25 feet (1,260 to 1,965 ft2). A determination of the size of the source area to cleaned up by an expanded, full scale UVB system is underway. However, the area likely won't be fully known until the soils and groundwater beneath the Vienna Cleaners building have been investigated. For the purposes of this document, an estimated area of 10,000 to 15,000 ft2 (125' x 80' to 150' x 100') includes the Vienna Cleaner's building footprint, two-thirds of the alley west of the suede shop, and a portion of the property west of the alley. Assuming the radius of influence to be 25 feet, and given the necessity of overlapping radii of influence of the UVB units, an estimated 4 to 7 units will be needed to effectively treat a primary source area."

B.6 A citizen wrote: Besides PCE, a number of other chlorinated organics are found. It should be noted that PCE is subject to a number of natural attenuation processes, including evaporation, dissociation, adsorption, and biological. The other organics are byproducts, less toxic, and also subject to natural attenuation processes

EPA Response: In actuality, some of the byproducts of PCE degradation are more toxic than PCE. However, As concluded in the Remedial Investigation, Section 5 *Contaminant Fate and Transport* "Biodegradation of chlorinated hydrocarbons, specifically PCE, in groundwater through reductive dechlorination is not occurring at the Site." PCE represents the most significant Chemical of Concern at the Site, However, EPA will continue to monitor for breakdown products as well.

B.7 A citizen asked: On page 5 (of the Proposed Plan), the Removal Action beginning in 1999 is presumably the UVB system which started operation in March 2001?

EPA Response: Yes, that is correct.

B.8 A citizen wrote: On page 6 (of the Proposed Plan), it should be clarified that the worst case scenario is a hypothetical assumption, which would not actually occur even in the no action alternative, since any concentrations which might ever reach the wells mentioned would be much lower than those assumed in the risk assessment.

EPA Response: EPA does not agree that the levels of contamination present in the aquifer will never reach the Vienna production wells 7 and 8. A detailed description of the assumption that EPA uses to calculate the Risk Assessment is published on page 8 of the Proposed Plan.

B.9 A citizen wrote: Beginning at the bottom of page 6 (of the Proposed Plan), the RME estimate of 5X 10-3 for hypothetical exposure should be compared with either (a) the assumptions used in the scenario, or (b) the MLE estimate, which would very likely be lower than 10-6. The "conservative" RME assumptions, while sometimes not individually unreasonable, will frequently combine to produce scenarios which are extremely hypothetical, if not impossible

EPA Response: The Risk Assessment portion of the Proposed Plan is designed to summarize the Human Health Risk Assessment Report for the Vienna PCE Superfund Site. The Risk Assessment itself incorporates the general methodology described in Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual, Part A (1998). Individuals wishing to view additional data on the Risk Assessment may access www.epa.gov/arweb and select the Vienna PCE Site.

B.10 A citizen wrote: On page 7 (of the Proposed Plan), even if the plume were to be approaching the vicinity of the river, it is not clear that the groundwater (50 feet below grade) would flow into the river, or if the river is in fact recharging the groundwater, and is therefore a natural barrier to any further westerly movement of the PCE plume. Even in the former case, the massive dilution would probably result in concentrations (in the river), that are multiple orders of magnitude below detection limits.

EPA Response: EPA agrees.

B.11 A citizen wrote: On page 8 (of the Proposed Plan), RAO 3, again, it has not been shown (via hydraulic gradient data) whether groundwater 50 feet deep would go into the river, or vice-versa. But it seems a stretch to say that water which might discharge into the Ohio River in very small quantities must be cleaner than drinking water standards.

EPA Response: The cleanup standards are primarily driven by the fact that the aquifer is being used as a source of drinking water. Achieving the cleanup standards will protect users of the aquifer as well as the Ohio River.

B.12 A citizen wrote: On page 9 (of the Proposed Plan), Remedial Alternatives, it seems that there is both EPA Guidance and logic for a "Continue Present Actions" Alternative; that is, to continue with the "hot spot" source removal and the existing configuration of municipal wells which has effectively stopped any risk for the past several years. This scenario is of high interest to the public because it is the real-world that they are now living with. Assuming that the current situation is perfectly safe, i.e. fully protective of human health and the environment (and I agree that there are no indications otherwise) then why not continue doing what is working acceptably, and would certainly cost millions less?

EPA Response: It is important to differentiate between the ongoing Removal Action and the forthcoming Remedial Action. The ongoing Removal Action is removing PCE from the soil and preventing further contamination from entering the aquifer. It is not considered fully protective of human health and the environment, the CERCLA standard that Superfund remedies are required to achieve since it does not prevent future human contact with contaminated groundwater. As such, "Continue Present Actions" (or more correctly "No Action") is not a viable alternative.

B.13 A citizen wrote: While I believe that a "Continue Present Actions" scenario may very well turn out to be preferable, the selection of Alternative 5 from the rest looks reasonable, if there is a good separation and evaluation of its two components: air sparging, and SVE. A realistic risk assessment, or Clean Air Act standards, will most likely show the SVE portion (and the higher-cost portion) to be unnecessary at any reasonable sparging rate.

EPA Response: While it is true that Soil Vapor Extraction is the more costly element of the Remedial Action, EPA is committed to permanently removing the contamination from below the City of Vienna, not simply moving the contamination from the groundwater matrix to a soil matrix.

B.14 A citizen wrote: Although air sparging installation details are not mentioned, simple installation with GeoProbe/wellpoint techniques, as opposed to more elegant drilling, casing, screening/etc, has been shown to be quite effective and far less costly. I suspect that a GeoProbe rig will also have a lot more success in a dense residential area.

EPA Response: EPA will evaluate the use of this technique during the Remedial Design.

B.15 A citizen wrote: Alternative 3, while clearly non- implementable in a city setting, may be improved for potential use on other sites with the substitution of Halliburton Soil Saw techniques for conventional excavation-type slurry wall installation.

EPA Response: EPA agrees that this technology may be more suitable at other Sites.

B.16 A citizen wrote: On page 18 (of the Proposed Plan), it's not clear what specific added institutional controls are proposed. Presumably the existing control (shutdown of two Vienna wells) is accomplishing the needed protection of human health and the environment, by ensuring that groundwater near the PCE plumes is not being pumped out and used.

EPA Response: The Institutional Controls deal with the possibility of new wells being constructed into the contaminated groundwater. While it is true that six municipal wells are no longer operating and effectively reducing risk, EPA wants to ensure that no citizens are exposed to contaminated groundwater by using private wells. Thus, Institutional Controls must be implemented at local levels to provide an additional level of protection and ensure that no one uses the contaminated groundwater until the cleanup standards are achieved.

B.17 A citizen wrote: Figure 3 of the Appendix (PCE concentrations, February 2001) shows reasonable coverage by monitoring wells to produce the concentration contours that are inferred, except for the lower concentration contours connecting the smaller Busy Bee Cleaners source across-gradient to the main body of the Vienna Cleaners plume. Such a connection would seem to require data from another monitoring well, and would also require contaminant movement along, rather than perpendicular to, the potentiometric contours shown on Figure 4.

EPA Response: EPA agrees, as depicted on Figure 3, the plume from the Busy Bee cleaners location does appear to have a more northerly component of flow than the plume from the Vienna Cleaners property. EPA will ensure that additional monitoring points are installed during the Remedial Design to ensure treatment of the smaller plume.

B.18 A citizen wrote: The significant message of Figure 3, however, is that the highest concentrations of PCE have only moved about three blocks down 29th street in the 50+ years since the Vienna Cleaners began operating in the late 1940' s. It would appear that the PCE plume would likely not emerge on the west side of the Manville Plant for decades more. Given the additional facts that waste PCE dumping has not occurred for decades, and a "gap" of much cleaner groundwater now exists back upgradient toward the source, a relatively lower-level threat is presented and a correspondingly lower-level remedy (than the current Proposed Remedy) is indicated.

EPA Response: EPA agrees that the plume is migrating at a relatively slow rate of speed. However, the contamination has already migrated approximately 1,500 ft, and has seriously threatened the City of Vienna's water supply. (Six municipal wells have already been taken out of service). Further, there are a number of influences on the plume in its current location that are not present at the Vienna Cleaners area that will accelerate its movement, namely the City of Vienna groundwater production wells. Groundwater modeling studies undertaken by EPA and the USGS indicate that the groundwater plume will accelerate as it draws closer to the City of Vienna production wells Thus EPA does not believe we should employ a "lower level" remedy to address this problem.

B.19 A citizen wrote: Figure 4 (potentiometric contours) shows a pretty flat water table, tilted only slightly toward the Ohio River. This means slow groundwater movement, reinforcing the message of Figure 3. At this close proximity to the river, it is likely that the groundwater and the river water are in communication, and both will typically rise and fall with the seasons. The result is little or no net movement of groundwater toward the river. The significant message of Figure 4 is that the two Vienna municipal wells shown are located well out of the current path of the PCE plume. To threaten these two wells, the PCE plume would apparently need some additional decades of travel time, and a near-90-degree turn.

EPA Response: EPA's current modeling data indicates that as the contamination moves toward and past the Johns Manville plant it is affected by the drawdown effect of the City of Vienna production wells 7 and 8. These wells have a large pumping rate (500,000 gals/day). As such, they are capable of significantly affecting the movements of the groundwater plume. The projected time to reach these wells is currently less than a decade and all models to date indicate that the near 90 degree turn is a probable occurrence.

B.20 A citizen wrote: PCE is known to be subject to degradation in groundwater, with EDC and TCE at relatively low levels being typically produced and then degrading. The contouring of the PCE plume (Figure 3) and the relatively clean "gap" back toward the source, where apparently large amounts of PCE are still being recovered from the soil, may imply that degradation is occurring at a finite rate, although it is likely limited by the lack of local dissolved oxygen; much of the area is covered by streets, buildings, homes, driveways, asphalt parking lots, etc so there is probably little local infiltration of oxygenated rainwater. Dissolved oxygen (supporting either hydrolysis or biological degradation of the PCE) is probably low in the center of the plume. Depending on the sampling protocols, dissolved oxygen is sometimes obtained and recorded as a field parameter. I suggest that DO readings be compared for wells both inside and outside the PCE plume; wells 09S, 11S, 08S, and 10S, for example. If an area of low DO is present, then a minimal amount of air sparging, directly in the center of the plume, would be very beneficial.

EPA Response: EPA completed a full sampling round of analysis of BOD, COD, DOC and other Natural Attenuation Parameters as detailed in the Remedial Investigation. As a result of this portion of the investigation, EPA concluded that biodegradation of chlorinated hydrocarbons, specifically PCE, in groundwater through reductive dechlorination is not occurring at the Site. However the Selected Remedy will do just as you suggest, as it will supply oxygen via air sparging directly in the center of the plume.

B.21 A citizen wrote: There are some aspects of Alternative 5 (Figure 8) which don't appear to be necessary, and/or appear to be impractical given the dense residential/ commercial nature of the area, (a) First, the array of 10 sparging/4 SVE wells shown west of the Manville Plant, does not appear to be needed at all, given the very slow plume movement, and would also be located directly on the railroad tracks (not shown) which parallel River Road. This array should be removed/deferred unless monitoring data show a need and a definite location, (b) Second, the area along 29th street is substantially covered with streets, parking areas, small businesses, churches, and homes. Placing the number of wells shown, with their associated piping, on the required spacings indicated, will be disruptive to the streets, sidewalks, driveways, parking lots, utilities (water, gas, sewer), storm drains, etc; not to mention the residents themselves. The disruption and probable impact on real estate values do not seem justified given the absence of any current risk, and the very slow movement of the PCE. As an alternate, it might be possible to find a single central location for a few wells to sparge small amounts of air into the very center of the highest PCE concentration, to enhance DO and the in situ degradation, without significant disruption. Obviously, there would be a large reduction of present- value cost (millions of dollars) associated with (a) deferring the western array of wells until/if a need arises, and (b) modifying the 29th street area to a few central air sparging wells, if DO data suggest a benefit.

EPA Response: With respect to the Air Sparging/SVE wells west of the Manville plant, EPA agrees that it may be appropriate to defer their installation as contamination has yet to reach this location. The location, timing and the spacing of these wells will be more fully evaluated during the Remedial Design.

EPA is aware of many potential obstacles which may interfere with well placement along 29th street. EPA intends to place the wells and piping along public right of ways under the streets, a more detailed evaluation of the location, spacing, and number of air sparging and SVE wells will be conducted during the Remedial Design.

In order to limit disruption of 29th street during the Remedial Action, EPA will work closely with the City of Vienna to minimize the impact to the residents. In addition to working closely with Vienna public officials, EPA will conduct a meeting in Vienna after the Remedial Design is complete, allowing residents the opportunity to view the final plans prior to the start of construction.

B.22 The State of West Virginia, through the Department of Health and Human Services commented that "Public water supply wells 7 and 8 appear to be hydraulically down gradient from the PCE plume.” There is concern that they may be contaminated by the PCE contamination in the future. While groundwater modeling may indicate that long term remedial cleanup programs could possibly allow use of these wells for domestic public water supply, the models require a number of assumptions. However, actual conditions may be different and adversely effect results.

Due to the uncertainty coupled with the likelihood of adverse public perception of using a contaminated aquifer, our department strongly recommends that the US EPA continue its monitoring program from the sampling points located between the plume and wells 7 and 8. If monitoring results do indicate that the plume is continuing to move towards those wells, other contingency plans may need to be developed to assure that water supplied to Vienna residents continues to meets all regulatory requirements of the federal *Safe Drinking Water Act* and West Virginia Public Water

System Rules.

EPA Response: EPA agrees with the West Virginia Department of Health and Human Services and will develop a Monitoring Plan detailing the extent and duration of monitoring for all phases of the Remedial Action. As part of the monitoring program, EPA will continue to monitor groundwater in the area between the plume and the public water supply wells 7 and 8.

Appendix

Attachment 1

Office of Environmental Remediation
1356 Hansford Street
Charleston, West Virginia 25301-1401
Telephone 304-558-2508, Fax 304-558-3998

West Virginia Department of Environmental Protection

Bob Wise
Governor

Michael O. Callaghan
Cabinet Secretary

September 24, 2002

Abraham Ferdas, Director, 3HS00
Hazardous Site Cleanup Division
Environmental Protection Agency, Region III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Re: **State of West Virginia Concurrence with Record of Decision (ROD)**
Vienna PCE Superfund Site
Vienna, West Virginia
CERCLIS Identification No. WVD988798401

Dear Mr. Ferdas:

This letter is to officially express the State of West Virginia, Department of Environmental Protection (DEP) Office of Environmental Remediation (OER) concurrence with the Record of Decision (ROD), dated September 2002, for the Vienna PCE Superfund Site, located in Wood County, Vienna, West Virginia.

The OER has actively participated in the investigation and the assessment of risks potentially present at the Vienna PCE site. Additionally, the OER has been actively involved in the selection of the proposed remedy.

The State looks forward to the implementation of the selected remedy which we believe will be protective both to human health and the environment, as well as providing for cost-effective remediation of the site.

Sincerely,

Ken Ellison

Ken Ellison, Director
Division of Waste Management

cc: Anthony Iacobono (EPA), Remedial Project Manager
Peter Ludzia (EPA), Chief of General Remedial Section
Donald Martin (WVDEP), Assistant Director, Division of Waste Management
Mark Slusarski (OER), Remedial Project Manager
Project File

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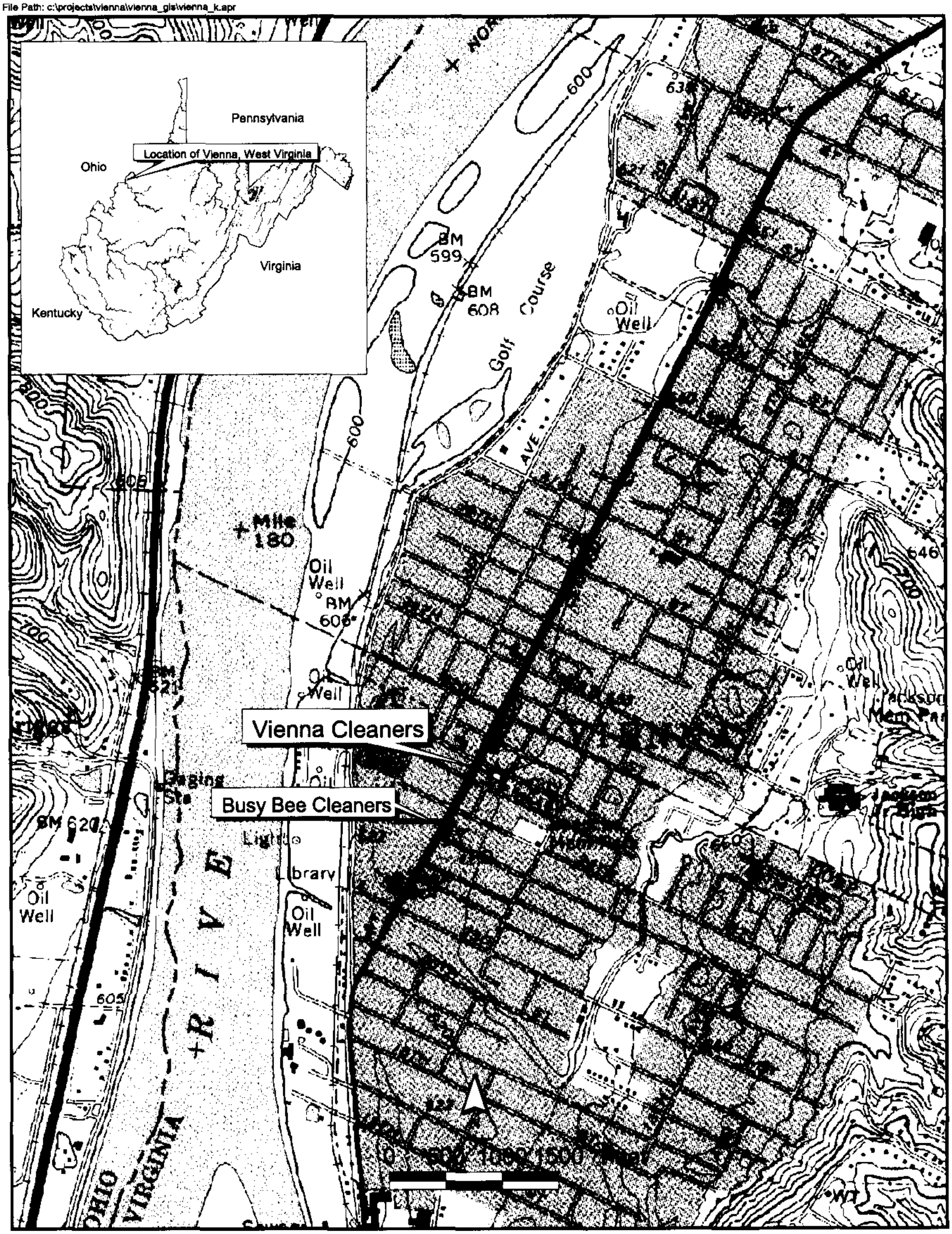

Vienna PCE Superfund Site
Vienna, West Virginia

Figure 1
Site Location Map

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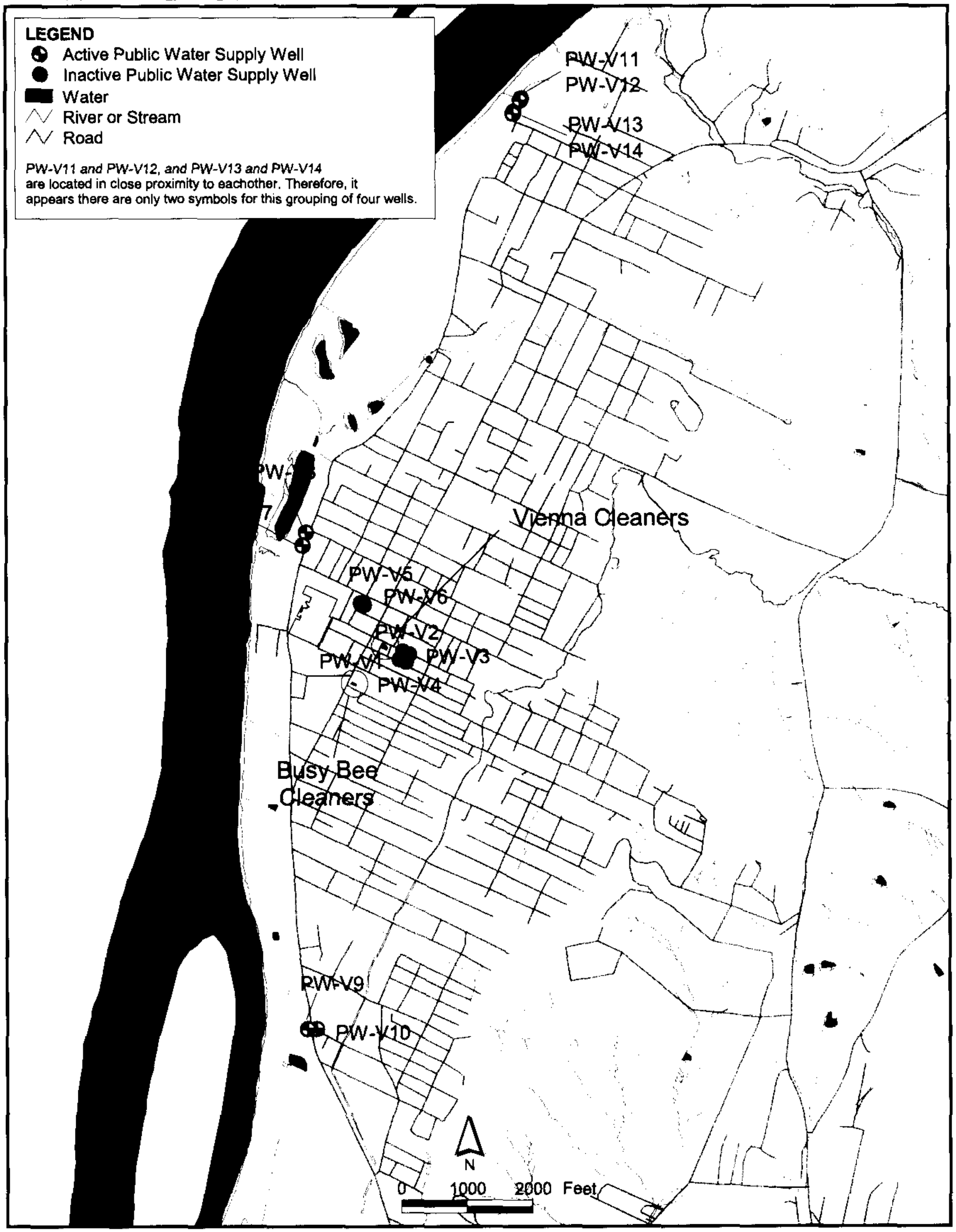
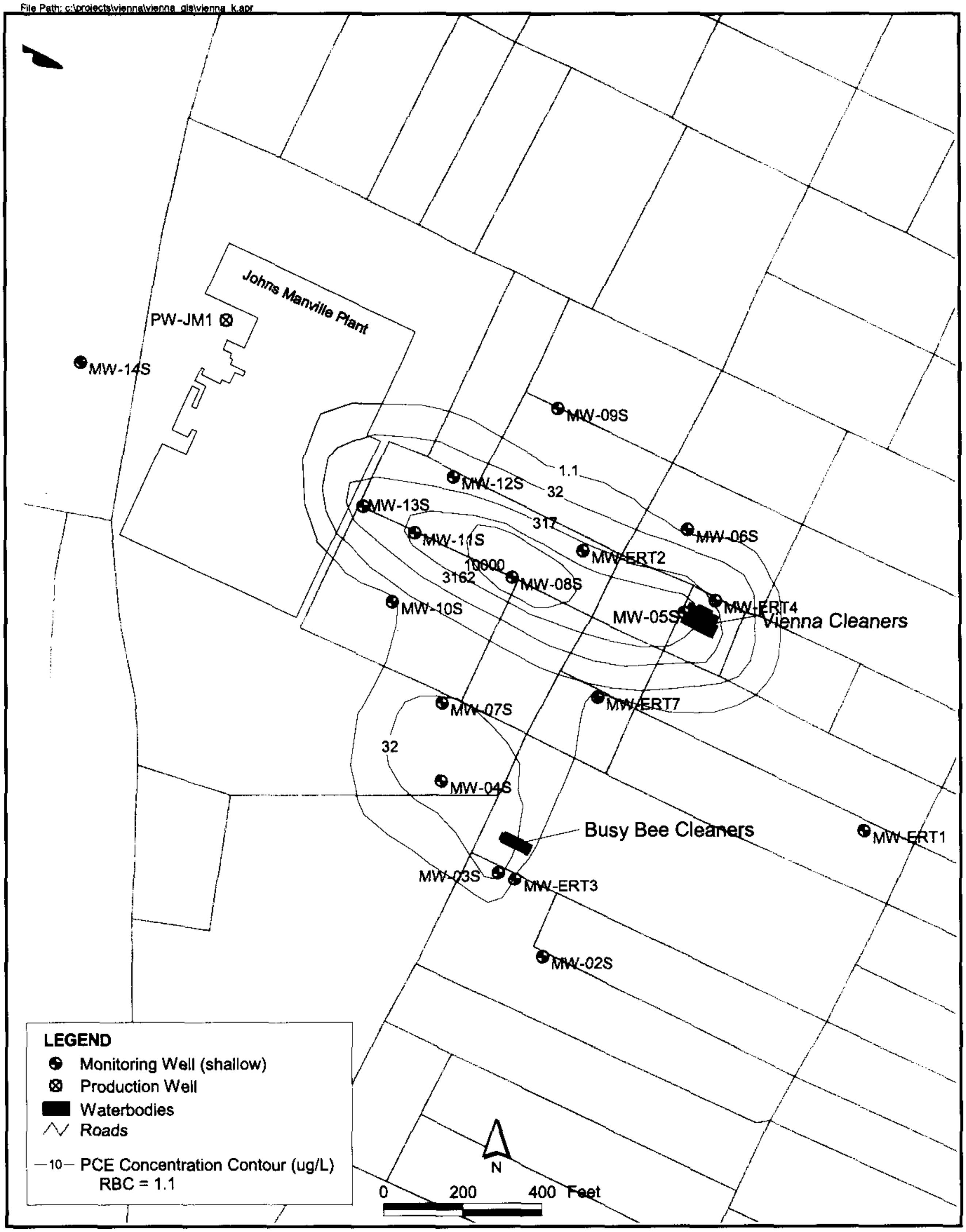


Vienna PCE Superfund Site
Vienna, West Virginia

Figure 2
Location of City of Vienna Municipal Supply Wells



Vienna PCE Superfund Site
Vienna, West Virginia

Figure 3
Round 1 Concentrations of PCE
in Shallow Groundwater Samples
February 2001

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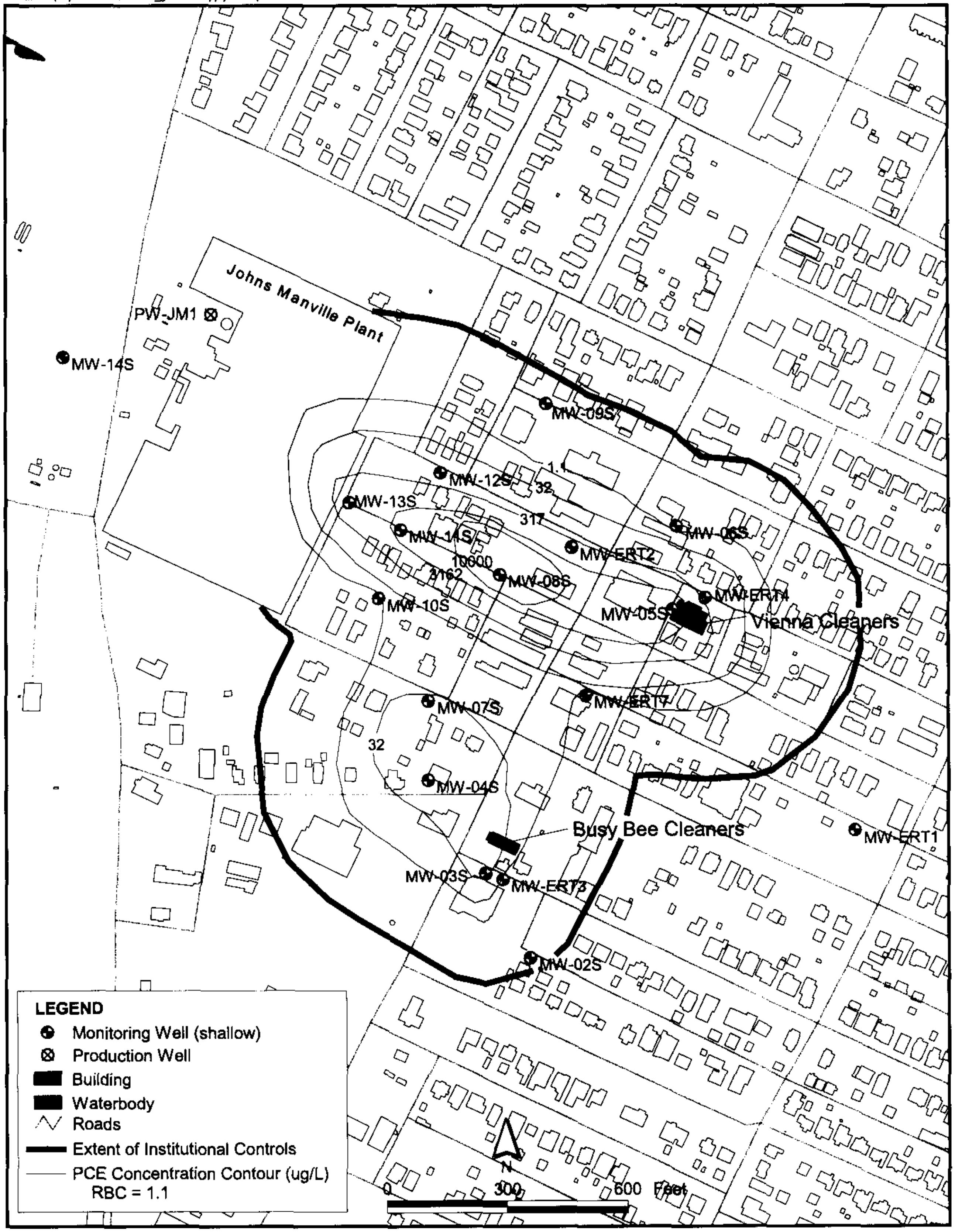

Vienna PCE Superfund Site
Vienna, West Virginia

Figure 4
Extent of Institutional Controls

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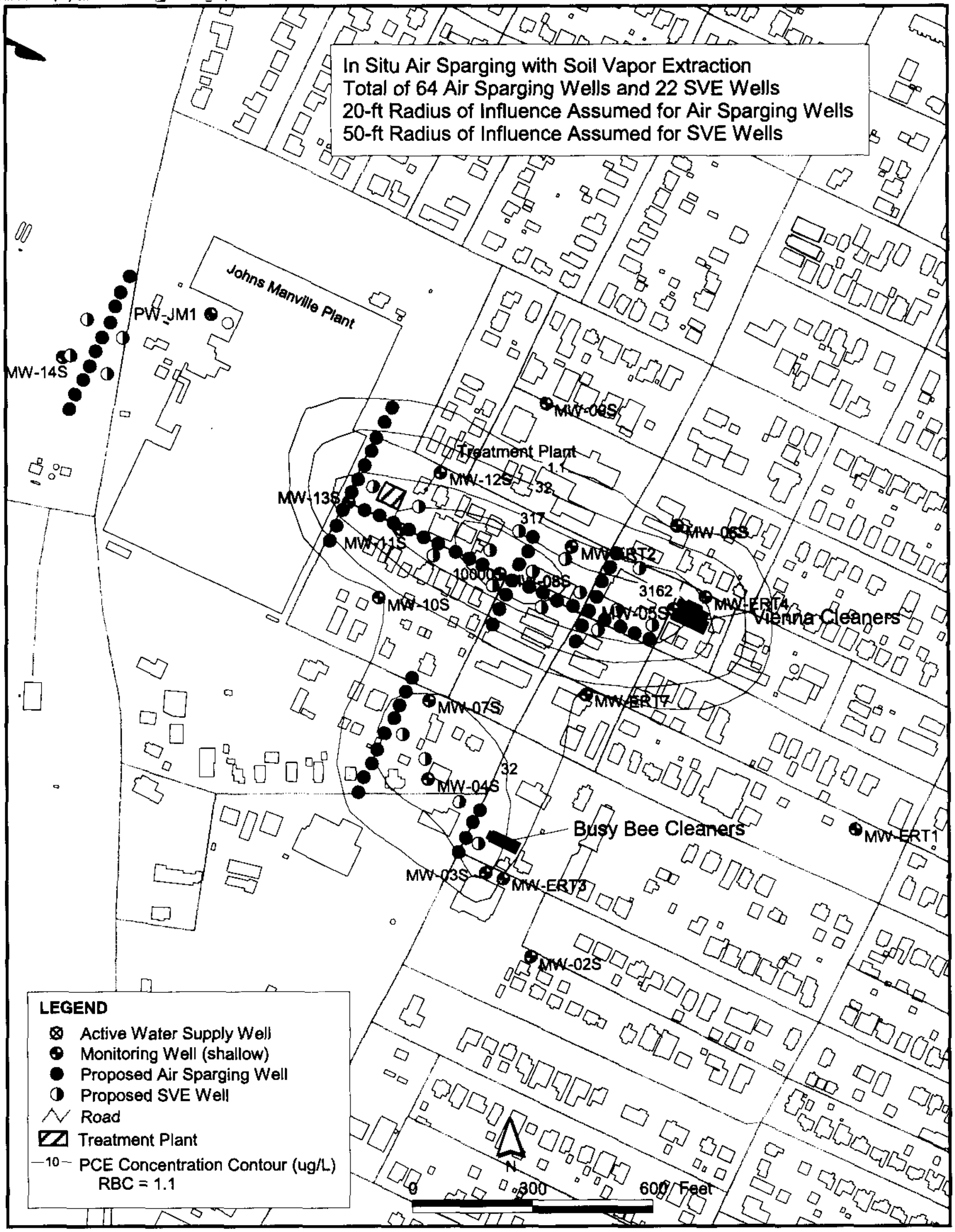

Vienna PCE
Vienna, West Virginia

Figure 5
Conceptual Layout of
Air Sparging/SVE System

Table 1

Contaminants of Potential Concern

Chemical	Maximum Concentration (ug/L)	MCL (ug/L)
Chloroform	.2	-
Antimony	2.6	6
Barium	97.3	2000
Calcium	110000	-
Magnesium	14800	-
Nickel	39.6	-
Potassium	1600	-
Sodium	27900	-
Vanadium	1.8	-
1,1-Dichloroethane	1	5
1,1,1-Trichloroethane	3	200
1,1,2-Trichloro-,1,2,2-triflouroethane	.2	-
1,2-Dichloroethane	10	5
1,2-Dichloropropane	.2	5
Carbon Tetrachloride	1	5
Chlorobenzene	19	100
Chloroform	.3	-
Cis 1,2-Dichloroethene	.7	-
MTBE	.2	-
Tetrachloroethene	15000	5
Trichloroethene	47	5
Trichlorofloromethane	.4	-
Di-n-butylpthalate	1	6

Table 2

Ground Water Chemicals of Concern

Contaminant	Range of Detection	Frequency of Detection	Exposure point Concentration	Statistical Measure
Tetrachloroethene	110 - 15000 ppb	36/51	10217 ppb	97.5%, Chebyshev
Trichloroethene	13 - 47 ppb	7/51	47 ppb	Max
1,2-Dichloroethane	3 - 10 ppb	3/51	10 ppb	Max

Key
ppb: parts per billion

The table presents the chemicals of concern (COCs) and exposure point concentrations for each of the COCs detected in groundwater (i.e., the concentration that will be used to estimate the exposure and risk from each COC in grounwaterl). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the exposure point concentration (EPC), and how the EPC was derived. The table indicates that tetrachloroethene (PCE) is the most frequently detected COC in groundwater at the Site. The 97.5% UCL was used as the EPC for PCE since the standard deviation was moderate. However, due to the limited amount of sample data available for trichloroethene and 1,2-dichloroethane, the maximum concentration was used as the default exposure point concentration.

Table 3

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

Vienna PCE

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal RfD (2)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: *Target Organ*	Dates of RfD: *Target Organ* (MM/DD/YY)
Carbon Tetrachloride	Chronic	7.0E-04	mg/kg/day	1	7.0E-04	mg/kg/day	Liver	1000	IRIS	02/11/02
Chlorobenzene	Chronic	2.0E-02	mg/kg/day	1	2.0E-02	mg/kg/day	Liver	1000	IRIS	02/11/02
Chloroform	Chronic	1.0E-02	mg/kg/day	1	1.0E-02	mg/kg/day	Liver	100	IRIS	02/11/02
1,1-Dichloroethane	Chronic	1.0E-01	mg/kg/day	1	1.0E-01	mg/kg/day	NOAEL	1000	HEAST	07/01/97
1,2-Dichloroethane	Chronic	3.0E-02	mg/kg/day	1	3.0E-02	mg/kg/day	Kidney/CNS/GI/Thymus	1000	NCEA	04/05/93
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	Chronic	1.0E-02	mg/kg/day	1	1.0E-02	mg/kg/day	Blood	3000	HEAST	07/01/97
Tetrachloroethene	Chronic	1.0E-02	mg/kg/day	1	1.0E-02	mg/kg/day	Liver	1000	IRIS	02/11/02
Trichloroethene	Chronic	3.0E-04	mg/kg/day	1	3.0E-04	mg/kg/day	Liver/Kidney/Fetus	3000	NCEA	03/11/02
1,1,1-Trichloroethane	Chronic	2.8E-01	mg/kg/day	1	2.8E-01	mg/kg/day	Liver	90	NCEA	08/04/99
Di-n-butylphthalate	Chronic	1.0E-01	mg/kg/day	1	1.0E-01	mg/kg/day	Whole Body	1000	IRIS	03/21/02
Antimony	Chronic	4.0E-04	mg/kg/day	0.15	6.0E-05	mg/kg/day	Longevity/Blood	1000	IRIS	02/11/02
Barium	Chronic	7.0E-02	mg/kg/day	0.07	4.9E-03	mg/kg/day	NOAEL	3	IRIS	03/18/02
Chromium (VI)	Chronic	3.0E-03	mg/kg/day	0.025	7.5E-05	mg/kg/day	NOAEL	900	IRIS	02/11/02
Manganese (nonfood)	Chronic	2.0E-02	mg/kg/day	0.04	8.0E-04	mg/kg/day	CNS	1	IRIS	07/13/01
Nickel	Chronic	2.0E-02	mg/kg/day	0.04	8.0E-04	mg/kg/day	Decreased Body and Organ Weights	300	IRIS	03/19/02
Vanadium	Chronic	7.0E-03	mg/kg/day	0.026	1.8E-04	mg/kg/day	NOAEL	100	HEAST	07/01/97

NOAEL = No-Observed-Adverse-Effect Level

NA = Not Available

CNS = Central Nervous System

GI = Gastrointestinal

IRIS = Integrated Risk Information System

HEAST = Health Effects Assessment Summary Tables, July 1997

NCEA = National Center for Environmental Assessment

(1) Oral to Dermal Adjustment Factor from Exhibit 4-1, RAGS Part E, Supplemental Guidance for Dermal Risk Assessment. Interim. EPA/540/R/99/005. September 2001.

(2) Adjusted Dermal RfD (mg/kg/day) = Oral RfD (mg/kg/day) x Oral to Dermal Adjustment Factor

Table 4

NON-CANCER TOXICITY DATA -- INHALATION

Vienna PCE

Chemical of Potential Concern	Chronic/ Subchronic	Value Inhalation RfC	Units	Adjusted Inhalation RfD (1)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfC:RfD: Target Organ	Dates (MM/DD/YY)
Carbon Tetrachloride	Chronic	2.0E-03	mg/m^3	5.71E-04	mg/kg/day	Liver	3000	NCEA	06/20/96
Chlorobenzene	Chronic	6.0E-02	mg/m^3	1.7E-02	mg/kg/day	Liver	1000	NCEA	09/18/98
Chloroform	Chronic	3.0E-04	mg/m^3	8.6E-05	mg/kg/day	Nasal	10	NCEA	12/01/97
1,1-Dichloroethane	Chronic	5.0E-01	mg/m3	1.4E-01	mg/kg/day	Kidney	1000	HEAST	07/01/97
1,2-Dichloroethane	Chronic	5.0E-03	mg/m^3	1.4E-03	mg/kg/day	GI/Liver/Kidney/Mucous Membrane	3000	NCEA	04/05/93
1,2-Dichloropropane	Chronic	4.0E-03	mg/m^3	1.1E-03	mg/kg/day	Respiratory System	300	IRIS	02/11/02
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	Chronic	4.9E-01	mg/m^3	1.4E-01	mg/kg/day	Liver, Kidney	300	NCEA	06/20/97
Trichloroethene	Chronic	4.0E-02	mg/m^3	1.1E-02	mg/kg/day	CNS/Liver/Endocrine System	1000	NCEA	03/11/02
1,1,1-Trichloroethane	Chronic	2.2E+00	mg/m3	6.3E-01	mg/kg/day	Liver Damage/Brain Injury	90	NCEA	08/04/99
Di-n-butylphthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	Chronic	5.0E-04	mg/m^3	1.4E-04	mg/kg/day	Fetus	1000	HEAST	07/01/97
Chromium (VI) - particulates	Chronic	1.0E-04	mg/m^3	3.0E-05	mg/kg/day	Lung	300	IRIS	02/11/02
Manganese	Chronic	5.0E-05	mg/m^3	1.4E-05	mg/kg/day	CNS	1000	IRIS	02/11/02
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA = Not Available

CNS = Central Nervous System

GI = Gastrointestinal

IRIS = Integrated Risk Information System

HEAST = Health Effects Assessment Summary Tables, July 1997

NCEA = National Center for Environmental Assessment

(1) Adjusted Inhalation RfD (mg/kg/day) = Inhalation RfC (mg/m^3) x 20 (m^3/day) / 70 (kg)

Table 5

CANCER TOXICITY DATA – ORAL/DERMAL

Vienna PCE

Chemical of Potential Concern	Oral Cancer *Slope Factor*	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal Cancer Slope Factor (2)	*Units*	*Weight of Evidence/* Cancer Guideline Description	Source	Date (MM/DD/YY)
Carbon Tetrachloride	1.3E-01	1	1.3E-01	1/mg/kg/day	B2	IRIS	02/11/02
Chlorobenzene	NA	NA	NA	NA	NA	NA	NA
Chloroform	6.1E-03	1	6.1E-03	1/mg/kg/day	B2	IRIS	02/11/02
1,1-Dichloroethane	NA	NA	NA	NA	C	IRIS	03/21/02
1,2-Dichloroethane	9.1E-02	1	9.1E-02	1/mg/kg/day	B2	IRIS	02/11/02
1,2-Dichloropropane	6.8E-02	1	6.8E-02	1/mg/kg/day	B2	HEAST	07/01/97
cis-1,2-Dichloroethene	NA	NA	NA	NA	D	IRIS	03/21/02
Tetrachloroethene	5.2E-02	1	5.2E-02	1/mg/kg/day	B2	NCEA	10/98
Trichloroethene	4.0E-01	1	4.0E-01	1/mg/kg/day	B1	NCEA	03/11/02
1,1,1-Trichloroethane	NA	NA	NA	NA	D	IRIS	03/21/02
Di-n-butylphthalate	NA	NA	NA	NA	D	IRIS	03/21/02
Antimony	NA	NA	NA	NA	NA	NA	NA
Barium	NA	NA	NA	NA	D	IRIS	03/18/02
Chromium VI	NA	NA	NA	NA	D	IRIS	02/11/02
Manganese	NA	NA	NA	NA	D	IRIS	02/11/02
Nickel	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA

NA = Not Available

IRIS = Integrated Risk Information System

HEAST = Health Effects Assessment Summary Tables, July 1997

NCEA = *National Center for Environmental* Assessment

(1) Oral to Dermal Adjustment Factor from Exhibit 4-1, RAGS Part E, Supplemental Guidance for Dermal Risk Assessment. Interim. EPA/540/R/99/005. September 2001.

(2) Adjusted Dermal Cancer Slope Factor (1/mg/kg/day) = *Oral Cancer Slope Factor (1/mg/kg/day)* / Oral to Dermal Adjustment Factor

EPA Group:

A - Human carcinogen

B1 - *Probable* human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate *or no evidence in humans*

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

Table 6

CANCER TOXICITY DATA -- INHALATION

Vienna PCE

Chemical of Potential Concern	Unit Risk	Units	Adjustment	Inhalation Cancer Slope Factor	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (MM/DD/YY)
Carbon Tetrachloride	1.5E-05	1/ug/m^3	(1)	5.3E-02	1/mg/kg/day	B2	IRIS	02/11/02
Chlorobenzene	NA	NA	NA	NA	NA	D	IRIS	02/11/02
Chloroform	2.3E-05	1/ug/m^3	(1)	8.1E-02	1/mg/kg/day	B2	IRIS	02/11/02
1,1-Dichloroethane	NA	NA	NA	NA	NA	C	IRIS	03/21/02
1,2-Dichloroethane	2.6E-05	1/ug/m^3	(1)	9.1E-02	1/mg/kg/day	B2	IRIS	02/11/02
1,2-Dichloropropane	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	D	IRIS	03/21/02
Tetrachloroethene	5.8E-07	1/ug/m3	(1)	2.0E-03	1/mg/kg/day	B2	NCEA	10/98
Trichloroethene	1.7E-06	1/ug/m^3	(1)	6.0E-03	1/mg/kg/day	B1	NCEA	03/11/02
1,1,1-Trichloroethane	NA	NA	NA	NA	NA	D	IRIS	03/21/02
Di-*n*-butylphthalate	NA	NA	NA	NA	NA	D	IRIS	03/21/02
Antimony	NA	NA	NA	NA	NA	NA	NA	NA
Barium	NA	NA	NA	NA	NA	NA	NA	NA
Chromium VI	1.2E-02	1/ug/m^3	(1)	4.1E+01	1/mg/kg/day	A	IRIS	02/11/02
Manganese	NA	NA	NA	NA	NA	D	IRIS	02/11/02
Nickel	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA

NA - Not Available

IRIS = Integrated Risk Information System

NCEA = National Center for Environmental Assessment

(1) Inhalation Cancer Slope Factor (1/mg/kg/day) = Unit Risk (1/ug/m^3)
x 70 kg / 20 m^3/day x 1000 ug/mg

EPA Group:

A - Human carcinogen

B1 - Probable human carcinogen - indicates that *limited human data are available*

B2 - *Probable human carcinogen* - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

Table 7
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Vienna PCE

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Air	Vapors from Groundwater entering Residents' Basements	1,1-Dichloroethane	NA	NA	NA	NA	1,1-Dichloroethane	Kidney	NA	0.0000006	NA	0.0000006
			1,1,1-Trichloroethane	NA	NA	NA	NA	1,1,1-Trichloroethane	Liver/Brain	NA	0.000001	NA	0.000001
			1,2-Dichloroethane	NA	6E-11	NA	6E-11	1,2-Dichloroethane	GI/Liver/Kidney/Mucous Membrane	NA	0.000001	NA	0.000001
			1,2-Dichloropropane	NA	NA	NA	NA	1,2-Dichloropropane	Respiratory System	NA	0.000007	NA	0.000007
			Carbon Tetrachloride	NA	8E-09	NA	8E-09	Carbon Tetrachloride	Liver	NA	0.0008	NA	0.0008
			Chlorobenzene	NA	NA	NA	NA	Chlorobenzene	Liver	NA	0.00005	NA	0.00005
			Chloroform	NA	6E-10	NA	6E-10	Chloroform	Nasal	NA	0.0003	NA	0.0003
			cis-1,2-Dichloroethene	NA	NA	NA	NA	cis-1,2-Dichloroethene	NA	NA	NA	NA	NA
			Tetrachloroethene	NA	2E-06	NA	2E-06	Tetrachloroethene	Liver/Kidney	NA	0.02	NA	0.02
			Trichloroethene	NA	1E-08	NA	1E-08	Trichloroethene	CNS/Liver/Endocrine System	NA	0.0006	NA	0.0006
			Di-n-butylphthalate	NA	NA	NA	NA	Di-n-butylphthalate	NA	NA	NA	NA	NA
			(Total)	NA	2E-06	NA	2E-06	(Total)		NA	0.02	NA	0.02
	Groundwater	Tap Water from Aquifer	1,2-Dichloroethane	9E-06	NA	NA	9E-06	1,2-Dichloroethane	Kidney/CNS/GI/Thymus	0.009	NA	NA	0.009
			Tetrachloroethene	5E-03	NA	NA	5E-03	Tetrachloroethene	Liver	28	NA	NA	28
			Trichloroethene	2E-04	NA	NA	2E-04	Trichloroethene	Liver/Kidney/Fetus	4	NA	NA	4
			Manganese	NA	NA	NA	NA	Manganese	CNS	2	NA	NA	2
			(Total)	5E-03	NA	NA	5E-03	(Total)		34	NA	NA	34
	Air	Water Vapors at Showerhead	1,2-Dichloroethane	NA	1E-05	NA	1E-05	1,2-Dichloroethane	GI/Liver/Kidney/Mucous Membrane	NA	0.3	NA	0.3
			Tetrachloroethene	NA	3E-04	NA	3E-04	Tetrachloroethene	Liver/Kidney	NA	3	NA	3
			Trichloroethene	NA	4E-06	NA	4E-06	Trichloroethene	CNS/Liver/Endocrine System	NA	0.2	NA	0.2
			(Total)	NA	3E-04	NA	3E-04	(Total)		NA	3	NA	3

Total Risk Across Groundwater: 5E-03

Total Risk Across All Media and All Exposure Routes: 5E-03

Total Hazard Index Across All Media and All Exposure Routes: 38

Total Liver	36
Total Kidney	7
Total Fetus	4
Total CNS	2
Total GI	0.3
Total Mucus Membrane	0.3
Total Nasal	0.0003
Total Endocrine System	0.2
Total Thymus	0.009
Total Respiratory System	0.000007
Total Brain	0.000001

Results from Tables 7.4.RME, 7.6.RME, 7.8.RME, 8.4.RME, 8.6.RME, and 8.8.RME.

NOAEL = No-Observed-Adverse-Effect Level
CNS = Central Nervous System
GI = Gastrointestinal
NA = Not Applicable

Table 8
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Vienna PCE

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Air	Vapors from Groundwater entering Residents' Basements	1,1-Dichloroethane	NA	NA	NA	NA	1,1-Dichloroethane	Kidney	NA	0.0000005	NA	0.0000005
			1,1,1-Trichloroethane	NA	NA	NA	NA	1,1,1-Trichloroethane	Liver/Brain	NA	0.000001	NA	0.000001
			1,2-Dichloroethane	NA	1E-11	NA	1E-11	1,2-Dichloroethane	GI/Liver/Kidney/Mucous Membrane	NA	0.000001	NA	0.000001
			1,2-Dichloropropane	NA	NA	NA	NA	1,2-Dichloropropane	Respiratory System	NA	0.000006	NA	0.000006
			Carbon Tetrachloride	NA	2E-09	NA	2E-09	Carbon Tetrachloride	Liver	NA	0.0006	NA	0.0006
			Chlorobenzene	NA	NA	NA	NA	Chlorobenzene	Liver	NA	0.00004	NA	0.00004
			Chloroform	NA	1E-10	NA	1E-10	Chloroform	Nasal	NA	0.0002	NA	0.0002
			cis-1,2-Dichloroethene	NA	NA	NA	NA	cis-1,2-Dichloroethene	NA	NA	NA	NA	NA
			Tetrachloroethene	NA	4E-07	NA	4E-07	Tetrachloroethene	Liver/Kidney	NA	0.02	NA	0.02
			Trichloroethene	NA	3E-09	NA	3E-09	Trichloroethene	CNS/Liver/Endocrine System	NA	0.0005	NA	0.0005
			Di-n-butylphthalate	NA	NA	NA	NA	Di-n-butylphthalate	NA	NA	NA	NA	NA
			(Total)	NA	5E-07	NA	5E-07	(Total)		NA	0.02	NA	0.02
	Groundwater	Tap Water from Aquifer	1,2-Dichloroethane	6E-06	NA	NA	8E-06	1,2-Dichloroethane	Kidney/CNS/GI/Thymus	0.02	NA	NA	0.02
			Tetrachloroethene	3E-03	NA	2E-03	5E-03	Tetrachloroethene	Liver	76	NA	37	113
			Trichloroethene	1E-04	NA	2E-05	1E-04	Trichloroethene	Liver/Kidney/Fetus	12	NA	2	13
			Manganese	NA	NA	NA	NA	Manganese	CNS	5	NA	NA	5
			(Total)	4E-03	NA	2E-03	5E-03	(Total)		93	NA	39	132

Total Risk Across Groundwater	5E-03
Total Risk Across All Media and All Exposure Routes	5E-03
Total Hazard Index Across All Media and All Exposure Routes	132

Total Liver	128
Total Kidney	13
Total Fetus	13
Total CNS	5
Total GI	0.02
Total Mucus Membrane	0.000001
Total Nasal	0.0002
Total Endocrine System	0.0005
Total Thymus	0.02
Total Respiratory System	0.000006
Total Brain	0.000001

Results from Tables 7.5.RME, 7.7.RME, 8.5.RME, and 8.7.RME.

NOAEL = No-Observed-Adverse-Effect Level
CNS = Central Nervous System
GI = Gastrointestinal
NA = Not Applicable

TABLE 9
CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED MATERIAL (TBCs) FOR THE SELECTED REMEDY
VIENNA PCE SUPERFUND SITE

ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Detail Regarding ARARs in the Context of the Selected Remedy
FEDERAL				
Groundwater Safe Drinking Water Act Maximum Contaminant Levels (MCLs)	42 U.S.C. §§ 300g-l 40 CFR Part 141.11-12 and 141.61-62	Relevant and Appropriate	MCLs are enforceable standards for public drinking water supply systems which have at least 15 service connections or are used by at least 25 persons. These requirements are relevant and appropriate since ground water in the vicinity of the Site is used as private drinking water supply.	The ground water remedy will meet these requirements. <u>Contaminant</u> <u>MCL</u> **Tetrachloroethene 5 ppb** **Trichloroethene 5 ppb** **1,2-Dichloroethane 5 ppb**
STATE				
Groundwater WV Ground Water Standards	WV CSR §46-12-3.1 to -3.5.a. and Appendix A	*Applicable*	Establishes minimum standards of pureness and quality for ground water resources within the State	The ground water remedy will comply with these standards. <u>Contaminant</u> <u>MCL</u> **Tetrachloroethene 5 ppb** **Trichloroethene 5 ppb** **1,2-Dichloroethane 5 ppb**

TABLE 10
LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED MATERIAL (TBCs) FOR THE SELECTED REMEDY
VIENNA PCE SUPERFUND SITE

ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Detail Regarding ARARs in the Context of the Selected Remedy
STATE				
Groundwater WV Groundwater Protection Regulations Practices for Industrial Establishments	WV CSR §47-58-4.10	Relevant and Appropriate	Facility or activity design must adequately address the issues arising from locating in karst, wetlands, faults, subsidences, or delineated wellhead protection areas determined vulnerable by the Director.	The substantive requirements of this regulation shall apply *if implementation of the* remedy occurs in such areas.

TABLE 11
ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED MATERIAL (TBCs) FOR THE SELECTED REMEDY
VIENNA PCE SUPERFUND SITE

ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Detail Regarding ARARs in the Context of the Selected Remedy
FEDERAL				
Air Federal Clean Air Act: Air Emission Standards for Process Vents	40 CFR Part 264.1030 - 264.1034 and 40 CFR Part 264.1053 - 264.1063	Applicable	Establishes requirements for process vents and equipment leaks.	To the extent the ground water remedy includes treatment by air stripping or other processes that would generate air releases, these requirements would apply.
Regulations Governing Hazardous Air Pollutants (NESHAPS)	40 CFR Part 61.242-1 through 61.244	Applicable	Requires emissions of Hazardous Air Pollutants (HAPs) from new/existing sources to be quantified; establishes ambient air quality standards and emissions limitations for HAP emissions from new sources.	To the extent the ground water remedy includes treatment by air stripping or other processes that would generate air releases, these requirements would apply.
Control of Air Emissions from Air Strippers at Superfund Groundwater Sites	OSWER Directive 9355.0-28, June 15,1989	To Be Considered	This policy guides the decision of whether additional controls (beyond those required by statute or regulation) are needed for air strippers at ground water sites.	This policy would be considered in determining the necessary emission controls. Sources most in need of additional controls are those with emission rates in excess of 3 lbs/hour or a potential rate of 10 tons/year of total VOCs.
STATE				
Groundwater WV Requirements Governing Water Conditions Not Allowable in State Waters	WV CSR §46-1-3.2 a-g	Relevant and Appropriate	Sewage, industrial waste, and other waste present in waters of the State shall not contribute to certain conditions including odors in the vicinity of waters, materials in concentrations which are harmful, hazardous, or toxic to man, animal, or aquatic life	Discharge from the Site, such as discharge associated with pump and treat operations, if any, into the waters of the State shall comply with these requirements to the extent appropriate under the circumstances.
Anti- Degradation Policy	WV CSR §46-1-4.a.,b.	Relevant and Appropriate	Requires protection of existing uses of state waters. Requires all new and existing point sources to achieve highest established requirements and employ best management practices for non-point sources	Any point source discharge from the Site into Ohio River shall meet the substantive requirements of this regulation.

TABLE 11
ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED MATERIAL (TBCs) FOR THE SELECTED REMEDY
VIENNA PCE SUPERFUND SITE

ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Detail Regarding ARARs in the Context of the Selected Remedy
Surface Water Mixing Zones	WV CSR §46-1-5	Relevant and Appropriate	Discusses conditions to be included in a permit concerning mixing zones.	Any point source discharge from the Site shall meet the substantive requirements of this regulation. No permit will be required.
Specific Surface Water Quality Criteria	WV CSR §46-1-8	Relevant and Appropriate	Requires that water designated for certain uses meet certain criteria.	Any point source discharge from the Site shall meet these criteria.
WV Pollutant Discharge Elimination System (WVPDES) Program	WV CSR §47-10-3 to 10-8 and 10-11 to 10-14.	Applicable	Establishes substantive requirements and limits for discharges to waters of the State.	Any point source discharge from the Site into the Ohio River will meet the substantive requirements of this regulation. No permit will be required.
Federal Effluent Limitations Guideline and Standards	WV CSR §47-10-15	Applicable	Incorporate the federal standards of 40 CFR Parts 400-460 concerning which discharges are permitted and which are not and sets standards for allowable discharges.	Any point source discharge from the Site into the Ohio River will meet the substantive requirements of this regulation. No permit will be required.
Subsurface borings	WV CSR §47-58.4.2	Relevant and Appropriate	Subsurface borings shall be constructed, operated and closed in a manner that protects ground water.	To the extent the remedial activities include subsurface borings, this requirement will be met.
Ground water monitoring stations	WV CSR §47-58-4-9.4. to 4.9.7.	Applicable	Establishes standards for location and construction of ground water monitoring stations.	The remedy will comply with these requirements.
Ground water remediation	WV CSR §47-58-8.1.2.	Applicable	Cleanup action shall not rely primarily on dilution and dispersion of the substance if active remedial measures are technically and economically feasible.	The selected remedy will achieve these requirements.
Ground water monitoring	WV CSR §47-58-8-1.3.	Applicable	Requires adequate ground water monitoring to demonstrate control and containment of the substance.	The remedy will comply with these requirements.

TABLE 11
ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED MATERIAL (TBCs) FOR THE SELECTED REMEDY
VIENNA PCE SUPERFUND SITE

ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Detail Regarding ARARs in the Context of the Selected Remedy
Monitoring Well Design Standards	WV CSR §47-60-1 to -60-21	Applicable	This rule establishes minimum acceptable documentation and standards for the design, installation, construction, and abandonment of monitoring wells and for the abandonment of all boreholes.	The substantive requirements of this regulation shall be met.
Air WV Air Quality Regulations Objectionable Odor Prohibited	WV CSR §45-4-3	Applicable	Prohibits discharge of air pollutants which cause objectionable odors at public locations.	The substantive requirements of these requirements will apply to the extent any remedial activities result in the discharge of an air pollutant(s) which cause or contribute to objectionable odors. No control program will be submitted.
Emission Standards for Hazardous Air Pollutants	WV CSR §45-15	Applicable	This rule adopts emission standards for hazardous air pollutants promulgated by the United States Environmental Protection Agency pursuant to section 112 of the federal Clean Air Act, as amended (CAA).	The substantiative requirements of this regulation shall be met.
Prevent and Control Air Pollution from Hazardous Waste Treatment, Storage, or Disposal Facilities	WV CSR §45-25-1 to - 25-3	Applicable	establishs a program of regulation over air emissions from the treatment, storage and disposal of hazardous wastes.	The substantiative requirements of this regulation shall be met.
Variance	WV CSR §45-4-6	Applicable	Requires that persons responsible for discharges of air pollutants causing objectionable odors develop an acceptable control program.	The substantive requirements of these requirements will apply to the extent any remedial activities result in the discharge of an air pollutant(s) which cause or contribute to objectionable odors. No control program will be submitted.

TABLE 11
ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND TO BE CONSIDERED MATERIAL (TBCs) FOR THE SELECTED REMEDY
VIENNA PCE SUPERFUND SITE

ARAR or TBC	Legal Citation	Classification	Summary of Requirement	Further Detail Regarding ARARs in the Context of the Selected Remedy
Facility Requirements for Owners and Operators of Hazardous Waste TSDs	WV CSR §45-25-4.3	Applicable	Requires owners and operators of hazardous waste surface impoundments, waste piles, land treatment units, and other units to operate and manage such facilities to minimize possibility of release of hazardous waste constituents into the air.	Applies to any remedial activities that may result in the release of hazardous waste constituents into the air.
Operating Permit Requirements	WV CSR §45-30-1 to -30-6	Applicable	Establishes requirements for permitting of air emission sources	The substantive standards of these requirements shall be complied with to the extent that remedial activities will result in emissions of air pollutants. No permit will be required.

TABLE 12

Cost Estimat for Air Sparging and SVE portions of the Selected Remedy

In Situ Air Sparging with Soil Vapor Extraction

Item	Quantity	Unit Cost	Units	Capital Cost	O&M Cost	
					Annual	*Present Worth*
(1) In Situ Air Sparging and Soil Vapor Extraction System Installation and 10 years of Operation						
(a) Pilot Testing	1	$100,000	LS	$100,000		
(b) Mobilization	1	$50,000	LS	$50,000		
(c) Site Services	9	$30,000	MO	$270,000		
(d) Health and Safety	9	$20,000	MO	$180,000		
(e) Hollow Stem Auger Drill Rig	120	$2,000	DAY	$240,000		
(f) Offsite Disposal of Drill Cuttings	140	$60	CY	$8,400		
(g) Air Sparging Well (materials)	64	$2,200	EA	$140,800		
(h) Soil Vapor Extraction Well (materials)	22	$1,250	EA	$27,500		
(i) Piping to Each Air Sparging/SVE Point	4,000	$50	LF	$200,000		
(j) Building for Air Sparging/SVE Air Handling System	5,000	$25	SF	$125,000		
(k) Air Blower	4	$4,100	EA	$16,400		
(l) Control Panel	1	$5,000	EA	$5,000		
(m) Gas Phase Carbon Adsorption	2	$12,000	EA	$24,000		
(n) Installation and Incidentals (piping, electrical)	1.5	$45,400	EA	$68,100		
(o) Treatment System Operator (20 hours/week)	1,040	$50	HR		$52,000	$365,226
(p) Carbon Media Replacement	3,000	$3	LB		$9,000	$63,212
(q) Utilities and Maintenance	1	$84,000	YR		$84,000	$589,981
(r) Deed Restrictions	1	$17,700	LS	$17,700		
Subtotal (1)				$1,472,900		$1,018,419
(2) Long-term Groundwater Monitoring						
(a) Quarterly (10 wells, years 1 and 2)						
(1) sample collection	1	$20,000	YR		$20,000	$36,160
(2) sample analysis (VOCs)	40	$200	sample		$8,000	$14,464
(b) Semiannually (10 wells, years 3 to 30)						
(1) sample collection	1	$10,000	YR		$10,000	$121,198
(2) sample analysis (VOCs)	20	$200	sample		$4,000	$23,601
(c) Treatment System Monitoring	1	$20,000	YR		$20,000	$140,472
(d) Review Data and Prepare Reports (annually)	1	$10,000	report		$10,000	$124,090
(e) 5-Year Review Reporting	1	$35,300	LS		$35,300	$76,177
Subtotal (2)				$0		$536,162
CONSTRUCTION SUBTOTAL				$1,472,900		
Contractor Overhead & Profit	30% of Construction Subtotal			$441,870		
CONSTRUCTION TOTAL				$1,914,770		
Permitting and Legal	2% of Construction Total			$38,295		
Engineering	20% of Construction Total			$382,954		
Services During Construction	20% of Construction Total			$382,954		

Contingency	10% of Construction Total			$191,477		
TOTAL CAPITAL COSTS				$2,910,450		
OPERATION & MAINTENANCE SUBTOTAL						$1,554,582
Project Management and Support	30% of O & M Subtotal					$466,374
TOTAL ESTIMATED COSTS				$2,910,450		$2,020,956
NET PRESENT WORTH OF COSTS				$4,931,406		